WORLD OIL

RE-EXAMINATION OF CASING DESIGN...60

COMPLETION PROBLEMS AT CITRONELLE...74

MAINTENANCE SAVES PLUG VALVES....85

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the world over

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58—101

Volume 146, No. 2 February 1, 1958

CURRENT OUTLOOK SECTION

Looking Ahead ... 23
Editor's Page ... 25
Why You Should Use Job Evaluation ... Robley D. Stevens 26
If Oil Could Speak ... 29
Expected Business Recovery Brightens Oil Outlook ... L. J. Logan 30
Facts the Banker Needs in Making Oil Loan ... C. R. Dodson 32
Report from the Observatory ... Warren L. Baker 39
Petroleum Trends in U. S. ... 39
Drilling Activities ... Cecil W. Smith 41

EXPLORATION SECTION

Dip Migration Improves Depth Calculations ... W. B. Robinson 45
Rotary Coring from Small Boats ... R. A. Mills 51

DRILLING SECTION

Safety, Profit and Drilling! ... D. L. Morgan 56
Let's Re-Examine Casing Design Considerations ... Robert J. Stoup 60
Special Additives Cut Cement Costs ... E. W. Porter 63
The Knowledge Box ... 70

PRODUCTION SECTION

New Solution Proposed for Dual Completions in Citronelle Field ... H. Gene White and Robert C. MacElvain 74
Maintenance of Salt Water Disposal Lines ... B. G. Cunningham 77
Pozzolanic Slurries for Injection Wells ... William F. Ball and Knox A. Slagle 79
How to Boost Production by Removing Water Blocks ... P. B. Burris 83
Proper Maintenance Extends Valve Life ... Paul A. Manor 85
Determining Oil-Water Contact from Production Data (Third in Series) ... Frank W. Cole 93

INTERNATIONAL SECTION

Sahara Oil Begins Moving to Market by Pipe Line ... Grace Halsell 97

DEPARTMENTS

Who's Meeting Where ... 21
Drilling Hints ... 112
Production Hints ... 120
What's Happening Among Men in the Industry ... 129
Deaths ... 135
Books ... 137
Association News ... 141
Companies in the News ... 145
What's Happening Among Service and Supply Men ... 146
Squeaks from the Bullwheel ... 158
Classified Advertising ... 163
Trading Post ... 163

NEW EQUIPMENT SECTION

What's New in Equipment ... 164
New Equipment Catalogs and Literature ... 177
ADVERTISERS' INDEX ... 178

WORLD OIL, published every month except semi-monthly in February and August. Entered as THE OIL WEEKLY as second class mail matter December 23, 1916, at post office at Houston, Texas, under the act of March 3, 1879.

WORLD OIL

Established 1916 as The OIL WEEKLY®

a quick look at this issue

BUSY OIL MEN: To help you put first things first, scan these time-saving digests on this and the following pages, checking ☑ those you want to read first.

CURRENT OUTLOOK

☐ **You don't need a consultant** to set up an efficient job evaluation program. All you need is to follow the step-by-step procedure as outlined on **Page 26** by a well known industrial relations authority. Also included are detailed descriptions of the four most popular types of job evaluation. **Why You Should Use Job Evaluation** ... **Dr. Robley D. Stevens**

☐ **If you need money,** you're no different from most oil and gas producers. Most of them are constantly in search of capital to drill wildcats or develop proven properties. To make this task easier, an expert on oil and gas loans explains bank requirements for the producers and independent consulting engineers. Turn to **Page 32. Facts the Banker Needs in Making Oil Loan** ... **C. R. Dodson**

EXPLORATION ARTICLES

☐ **Drilling depth predictions can be improved** by applying dip migrations to calculations. Beginning on **Page 45** is a complete explanation of the effect of dip migration on the depth and dip of the reflected horizon. **Dip Migration Improves Depth Calculations** ... **W. B. Robinson**

☐ **An inexpensive coring method** in shallow Gulf of Mexico waters has been undertaken successfully by Magnolia Petroleum Company. Magnolia uses hydraulic rotary equipment mounted on small exploration boats capable of moving from one location to another without tow boats. Ten-foot cores have been recovered 80 feet below the ocean floor in water 50 feet deep. Turn to **Page 51** for a complete description of equipment and operating methods. **Rotary Coring from Small Boats** ... **R. A. Mills**

Turn the Page ▸

COMING – NEXT ISSUE – FORECAST — REVIEW INFORMATION

Shown below are excerpts from an article by editorial director Warren Baker in last year's February 15 issue. Note the accuracy of his predictions.

Oil Needs Wiser Management

Better management of U. S. producing and refining volumes must be exercised by the oil industry in 1957. How wisely U. S. producing and refining volumes are regulated to fit widely fluctuating requirements will determine if 1957 is a good year or just the biggest oil year in history.

The mistakes of 1956 and 1955 must be avoided. It is unlikely that another Suez Canal condition will arise to bail the industry out of troubles created by its own mistakes.

Greater fluctuation in requirements will be experienced in 1957 because of the temporary nature of the Suez Canal blockage. Therefore, it will be of much greater importance than ever before that the industry wisely manages its producing and refining levels . . .

•

. . . and . . . the one troublesome economic problem at present is the matter of excessive gasoline inventories. Europe wants crude oil and fuel oils, not gasoline.

The industry has made a near fatal mistake in letting gasoline stocks get too large. This could have been avoided if refinery crude runs had been reduced by a mere 100,000 barrels per day along with a one percent downward adjustment in refinery gasoline yields between the end of April and the end of September. Now the industry must take more drastic steps to correct the situation. Immediate action is necessary. Otherwise, ruinous depressed motor fuel prices are likely.

Wise management of refinery operations during the next four or five months can keep the gasoline problem from destroying the economic advantages of record consumption, and protect the recent economic improvements achieved recently that included higher crude oil and refined product prices.

•

A little later in the year will come the problem of adjusting U. S. operations when the Suez Canal is reopened to Middle East shipments. Demand for U. S. oils will taper off sharply at that time. Unfortunately, it seems likely that the reopening of the canal will occur simultaneously with the normal seasonal second quarter demand drop in requirements. Consequently, second quarter demand may be as much as 1½ million barrels less than in the first 3 months of the year.

Here will be another instance whether the industry will need to demonstrate wise management of its operating levels. Refinery crude runs and crude production will need to be trimmed to volumes dictated by reduced consumption.

•

Unless the industry wisely regulates its production and refinery volumes in 1957, it will be going right back into its old rut of creating excessive stocks through its own fault. This could lead only to market weaknesses. The industry would then fail to reap the benefits it should enjoy from experiencing its biggest year in history.

On the other hand, if the industry will manage its production and refining operations sensibly, 1957 will be the best year as well as the biggest year in history. What happens will depend on the industry's actions.

Warren L. Baker

How true

And it still is

Sharp evaluation

I did!

On the button

So true

Watch for your February 15 special issue of WORLD OIL. Its review of 1957, plus predictions for 1958, will enable you to make your own industry evaluation.

DRILLING ARTICLES

☐ **Field men responsible for designing and running casing** strings have long relied on handbooks and charts without a full understanding of the basic reasons for design procedures. Thus, they blindly accept "safety factors" and then hedge on well loading assumptions. A better method would be to critically study and then modify the design factors according to each case. Turn to **Page 60** for several points in favor of this modified designing. **Let's Re-Examine Casing Design Considerations**.....**Robert J. Stoup**

☐ **Does the drilling contractor realize the true proportions of direct and hidden costs of accidents?** Is drilling a rough and tough task where accidents have to be expected? Turn to **Page 56** for a searching look at the ever-present problem of safety and a point-by-point program that can mean greater benefits for the contractor and his employes. **Safety, Profit and Drilling!**.....**D. L. Morgan**

☐ **Cost-cutting cementing procedures** have been verified in the field. Laboratory tested and field proven are: the use of a special diatomaceous earth to reduce slurry density, a cellulose derivative to control water loss and thickening time, and the use of sodium silicate as an accelerator. The results of ten tightly controlled tests on 279 wells are described in the article beginning on **Page 63. Special Additives Cut Cement Costs**.....**E. W. Porter**

PRODUCTION ARTICLES

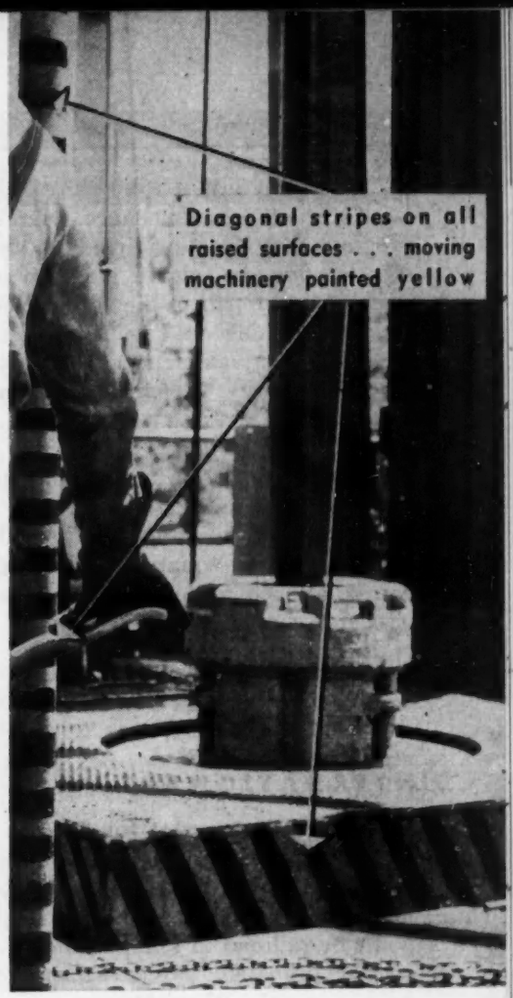
☐ **Dual-completion problems** are knotty in Alabama's Citronelle field. Present methods are too costly, say the authors of an article starting on **Page 74.** Their proposed solution: Scotch commingling. It's neither Scotch nor is it commingling. But it is described as a money-saving process: a single tubing string with one-way valves will allow production from upper and lower zone to commingle without possibility of return flow to the formation. It could benefit operators in other areas with similar problems. **New Solution Proposed for Dual Completions In Citronelle Field**.....
H. Gene White and Robert C. MacElvain

☐ **Here's a quick and easy** method of chemically cleaning salt water disposal lines and maintaining them in that condition. Acid solvents are used to remove scale deposits. The complete cleaning operation requires only 4 to 6 hours. See **Page 77. Maintenance of Salt Water Disposal Lines**.....**B. G. Cunningham**

☐ **Pozzolanic material in cement** is providing additional flexibility in oil field cementing programs. The properties of this mixture along with case histories of field experience present a picture that production men will find interesting. See **Page 79** for details. **Pozzolanic Slurries for Injection Wells**.....
William F. Ball and Knox A. Slagle

☐ **Water blocks**—what causes them and what can be done about them? The problem of reducing a water block condition across the face of a producing one is discussed in easy-to-understand fashion in the article beginning on **Page 83. How to Boost Production by Removing Water Blocks**.....**P. B. Burris**

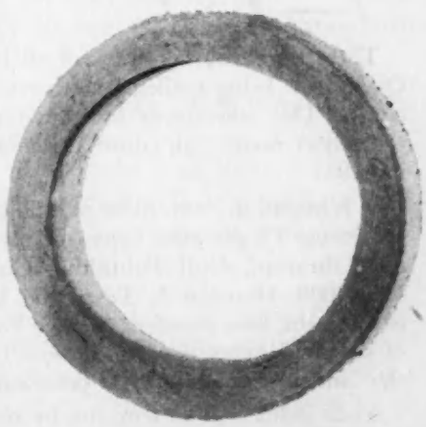
One way to prevent accidents



turn to page 56 for others

before cleaning

after cleaning



Turn the Page

THIS ISSUE *Continued* . . .

☐ **Prolong valve life** with a planned program of preventive maintenance. Here's an outline of a program that can be adjusted to the individual needs of any company; also a guide to lubrication periods, cleaning and repair of the valves. You'll also find in the article beginning on **Page 85,** a detailed discussion of the installation, maintenance and repair of wellhead and flow line valves. **Proper Maintenance Extends Valve Life**.....**Paul A. Manor**

☐ **In many cases** it is desirable to know the change in the oil-water contact after the reservoir has been produced for some time. A calculation, based on the Darcy flow equation and using production data, can be applied to determine the actual position of the oil-water contact. Turn to **Page 93** for the third part of this series For Your Production File. **Determining Oil-Water Contact from Production Data**.....
Frank W. Cole

INTERNATIONAL

☐ **A market outlet for Sahara oil is being provided.** A ten-inch crude oil pipe line from Hassi-Messaoud oil field to Touggourt has been completed. Crude will be moved through it and then from Touggourt by railroad to Philippeville on the Mediterranean coast. Ultimately, large diameter pipe lines will be built from the Hassi-Messaoud and Edjele fields to Mediterranean ports. See **Page 97. Sahara Oil Begins Moving to Market by Pipe Line**.....**Grace Halsell**

Have you forgotten something?

The 1957 Editorial Index of all 14 issues of WORLD OIL is now being mailed free to subscribers requesting copies. This convenient index covers, by author and by subject matter, all editorial material published during 1957.

It is bound in convenient pamphlet form for a ready reference. To get your copy, merely send a request to the Librarian, Gulf Publishing Company, Postoffice Box 2608, Houston 1, Texas. Or if you prefer, you can use the Blue Readers' Service Postcard in the back of this and every issue of WORLD OIL. Merely check the "index" square on the postcard and mail it.

Your index will be sent you by return mail. But act now. The supply is limited.

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SUBSCRIPTIONS

T. A. Gaden, Subscription Manager, P. O. Box 2608, Houston, Texas, U. S. A.

Single copies 50 cents (except special issues). Double prices for single copies more than one year old. Subscription price: domestic and foreign, $2 a year.

WORLD OIL published every month except semi-monthly in February and August.

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Specialized oil publications of THE GULF PUBLISHING COMPANY 3301 Buffalo Drive, Houston 19, Texas; Box 2608, Houston 1, Texas. Cable Address: GULFPUBCO.

WORLD OIL and THE COMPOSITE CATALOG for the drilling-producing industry.

PETROLEUM REFINER and THE REFINERY CATALOG for the refining-natural gasoline-petrochemical industry.

PIPE LINE INDUSTRY and THE PIPE LINE COMPOSITE CATALOG for the oil and gas pipe line industry.

Indexed by Industrial Arts Index and Engineering Index

Looking Ahead . . .

Steel for Oil Will Cost More . . . Oil industry costs continue to rise. Steel prices are expected to be increased again by at least $7 a ton at mid-year. The raise will be needed to cover another wage increase scheduled under the 3-year contract between union workers and steel companies.

Memphis Case May Force Gas Law Change . . . A blessing in disguise is seen by FPC Chairman Jerome K. Kuykendall, in viewing the recently-appealed Memphis case decision. It threatens to throw natural gas transmission and distribution into chaos. The new court interpretation of the Natural Gas Act stresses the urgency of amendment and clarification of the law, in the interests of consumers and also distribution, transmission, and producing branches of the industry. If upheld, the recent decision would prevent a gas pipe line from increasing its price of gas to distributors without their consent.

No Trouble for Oil in Venezuela—So far . . . The abortive Venezuelan revolt left the oil industry unaffected. But discontent shown by the revolution attempt bodes future trouble.

Libyan Field Must Be Big to Be Good . . . Libya's first oil, found by Esso Standard (Libya) Inc. at Haghe 2 in the Fezzan, was highly speculative in mid-January. The well was believed capable of yielding 250 barrels per day of 45 gravity oil from Ordovician sand at 2100-2140 feet. The sand is probably blanket-type, not lenticular, and there may be a big oil rim circling the big surface structure Esso is testing . . . **But**—the location, about 75 miles southeast of Algeria's Edjele field (Page 97), is very remote, more than 350 miles south of the Mediterranean Coast. The field will have to be a major one—at least 200 million barrels proved reserves—before it can be considered commercial, at least within the next few years.

Deep Wildcat Planned for Florida . . . Florida oil exploration may soon get an important shot in the arm. Temple Hargrove and Gulf Oil Corporation were reported interested in drilling a joint test near Tampa, projected to 15,000 feet.

Oil Operations Normal in Indonesia . . . Trouble in Indonesia had not hit the oil industry materially at mid-January. Current difficulty is mainly in Java. Oil industry operates more in Sumatra, which is more friendly to private enterprise. Indonesian military forces realize that a shutdown of refineries would deprive military vehicles and aircraft of fuel. They have strongly warned citizens against tampering with Royal Dutch Shell facilities. U. S.-run Caltex and Standard-Vacuum operations also have been left alone.

Fuel Oil From Colorado Shales Now on Market . . . Union Oil Company of California had sold 12,000 barrels of fuel oil extracted from Colorado oil shales for industrial use by early January, 1958. Purpose of the sales was to empty storage facilities, make room for additional production, and develop future markets. The process is not competitive with ordinary fuel oils at present. But it is now getting a toehold on markets and bears watching.

Submarine Tankers in the Future? . . . Mitchell Engineering Ltd. is doing hydrodynamic tests on the Isle of Wight on the south coast of England to determine if nuclear-powered submarine tankers are feasible. Submersible tankers in the order of 100,000 tons are visualized. Such tankers would be capable of speeds up to 45 knots and might be more reliable in time of war.

Good Wells Make Good News

A Monthly Report Of Successful Well Treatments

February 1, 1958

Operators who want to reduce production costs and increase ultimate recovery and profits are using Dowell acidizing more and more. Here are some recent examples showing how Dowell "tailors" acid treatments to the requirements of the well.

- **Plaquemines Parish, South Louisiana.** Dowell acidizing increased gas production from 2 million to 4 million cfd at a cost of $1003. Treatment paid out in about 5 days, based on 10 cents per thousand for gas. This well, in the Main Pass area, was completed in the Miocene sand (7967 to 7978 feet). A three-stage treatment was used, beginning with 500 gallons of low surface tension acid. Next, 500 gallons of Mud Acid was injected, then another 500 gallons of low surface tension acid. *This treatment has worked well in many Miocene sands. Although these sands exhibit low solubility in regular acid, many show 35 to 45 per cent solubility in Mud Acid.*

- **Galveston Bay, Texas Gulf Coast.** Gas delivery from this well was nearly tripled and the operator received a six-day payout as a result of a Dowell acidizing treatment. This well had been completed in the Frio sand (10,369 to 10,375 feet). Gas deliverability to the pipe line had declined to 692 mcfd. Dowell acidized, using 1000 gallons of low surface tension acid. Treatment down tubing averaged 1¼ bpm at 2900 psi, breaking to 1500 psi. Cost of the treatment was $480. *After treatment, deliverability rose to 1900 mcfd. This represented a net gain of over 1200 mcfd.*

- **McKenzie County, North Dakota.** Potential of this new well was increased from 41 bopd to 440 bopd after a treatment by Dowell using 2500 gallons of Mud Acid. This well, completed in the Sanish sand (10,320 to 10,330 feet) of the Antelope field, had tested 41 bopd before being killed with mud to set up for a dual completion. Since the packer was set at 9296 feet, a large volume of mud had to be removed from the annulus as well as the formation face. *Dowell treated with 30 gallons Freflo® in 33 barrels lease crude followed by 2500 gallons Mud Acid down tubing. Breakdown pressure was 8900 psi and acid was displaced at 5700 psi.*

- **Beaver County, Oklahoma.** A new well potentialed 480 bopd through a ¼-inch choke after Dowell performed a two-stage acidizing treatment. The well, completed through perforations into the Chester lime (6542 to 6563 feet), died after 30 minutes flush production. Dowell acidized with 500 gallons Mud Acid, and the well was swabbed. Then 5000 gallons Retarded Acid was injected down tubing at 4 bpm and at pressures ranging up to 1000 psi. *After the well was swabbed clean, it made 292 barrels of oil in the first 8½ hours.*

Dowell now offers 41 addition agents to "tailor" acid to your requirements. Moreover, your Dowell engineer has an unparalleled fund of experience and laboratory facilities upon which to draw when he helps you plan a treatment. Each acidizing treatment he recommends is designed to give you the best results for your money. For more information or service, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write Dowell Incorporated, Tulsa 1, Oklahoma.

Services for the oil industry DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

Let's answer the critics

"Of all the tax avoidance gimmicks, percentage depletion provides the biggest windfalls."

The above statement appeared last month under a three-column headline in one of the nation's largest newspapers. Millions of people, oil industry employes included, read the one-sided bombardment against oil's depletion provision.

Opinions were formed—*against* the oil industry.

Throughout 1957 the nation's most widely read union publications kept up a relentless attack against "big, profiteering" oil companies. Some of the anti-oil cartoons that appeared would turn a businessman's stomach. Millions of union members, oil industry employes included, saw this vicious attack against oil.

Opinions were formed—*against* the oil industry.

In recent months, oil industry critics in top government circles have pulled out all stops in their criticisms of the oil industry. The news reports of these attacks—natural gas, oil prices, anti-trust, S-11, depletion, Elkins Act—were read by millions of people, oil industry employes included.

Opinions were formed—*against* the oil industry.

•

Who is to blame for a situation which allows the press, unions and government officials to verbally rip apart one of the nation's most vital industries? None of these groups intentionally attack issues the public understands and is in favor of—not when subscribers, members or votes hang in the balance.

This leaves only one possible answer. Through the mistaken belief that "being responsible" is the only factor needed to win the good will of the public—through its resulting failure to fight fire with fire, the oil industry has allowed its critics to create a public opinion climate that is receptive to unwarranted attacks against oil operations in general.

•

The situation can be corrected, although much damage has resulted from this ultra-conservative attitude. And the best place to start is right in our own house—among the industry's 1,650,000 employes and several hundred thousand stockholders.

In support of this statement, a recent survey showed that:

- Three out of every four Americans learn about the oil industry from personal contacts with people in it.
- Through service station personnel alone, the oil industry has face-to-face contacts with each of the 65 million American motorists at least 73 times a year.
- The average oil industry employe talks to 16 persons a week—nearly 20 million opportunities to put in a good word for oil to friends and neighbors each week!

These groups haven't been completely neglected by the oil industry. Far from it. The Oil Information Committee has prepared excellent material for employes and the public. And some companies have used it—but not enough.

Reaction to two recent World Oil booklets prepared to inform industry and non-industry people about oil's side of important issues clearly indicates the oil industry is taking steps in the right direction. More than 100 companies and oil associations ordered nearly 250,000 copies of the eight-page "Facts You Should Know About Oil Prices" which appeared in World Oil last March. Nearly 75,000 copies of last November's "What You Should Know About Federal Control of Natural Gas" have been distributed.

However, even this show of interest is but a drop in the bucket.

•

To be successful in changing some of the negative and erroneous opinions that have already been formed, the effort must be industry-wide and company-wide. The story presented must be factual and fair.

Oil's critics make effective use of the printed word to criticize and belittle the industry in the eyes of employes and the public. It is high time the oil companies used the same medium to tell the same people oil's side of the story.

In a few brief words, let's start forming opinions too—*for* the oil industry.

Why You Should Use

JOB EVALUATION

There is one sure way to erase wage dissatisfaction: Set up a sound "job evaluation" plan based on a thorough "analysis" of every job in your company.

By Robley D. Stevens
Management Consultant, Washington, D. C.

DISSATISFACTION OVER pay rates does more to impair employe efficiency, encourage absenteeism, lower morale and increase labor turnover than perhaps any other factor.

There is one sure way to eliminate this morale and efficiency destroyer—set up a sound and practical *job evaluation plan* based on a thorough *analysis* of every job in your organization. Such a program will eliminate the hazards of arbitrary personal opinions and habit in the determination of wage rates by:

- Defining the duties and responsibilities of each job.
- Setting up basic and consistent policies for compensation.

JOB ANALYSIS

What It Is. Job analysis is the process of determining by observation and study, pertinent information relating to the nature of a specific job. It is the determining of the tasks which comprise the job and of the skills, knowledges, abilities, and responsibilities required of the employe for the successful performance of his job. It differentiates one job from all the others.

To be useful for job evaluation, a job analysis should yield a very detailed and specific break-down of all jobs. Such an analysis should provide an organized picture of the abilities which, upon the basis of careful job study, appear to be significant in job competence. Collection of the necessary data in a systematic, orderly way not only reduces effort that might otherwise be dissipated, but it is also helpful in insuring adequate coverage and weighing of all aspects of the job.

What It Comprises. Actually, there are three parts in the analysis of any job:

1. The job must be completely and accurately identified.
2. The tasks of the job must be completely and accurately described.
3. The requirements the job makes upon the worker for successful performance must be indicated.

Job analysis can be used to determine job requirements and the specific qualities required of workers to fill jobs, for recruitment and placement purposes. Workers cannot be trained adequately unless the nature, duties, responsibilities, and like factors of the jobs for which they are being trained are known. By supplying complete information on the nature of all the jobs, it provides the basis for establishing efficient organization plans.

How to Set It Up. The first step in the analysis of jobs is an exact determination of what jobs are and their precise limits, that is, where the jobs begin and where they end.

Jobs in a refinery should be analyzed as they exist, each completed job analysis schedule describing one job as currently found in the particular firm being studied.

Contrary to popular belief, your company need not necessarily engage outside counsel to install the system referred to. All that is really essential is reasonable intelligence, objectivity, and a willingness to do the work. This means collecting complete, accurate and intelligible descriptions from the worker himself as well as from his supervisor.

The employe can do his part by filling out a questionnaire supplied by the personnel department. Such participation will help sell the job evaluation plan to the workers, who will feel greater confidence in themselves and in your management by getting a clearer grasp of their functions and duties.

In making a job analysis for job evaluation purposes, the technician should interview inferior as well as superior workers. Both can help to provide a picture of typical job duties and the kinds of information needed to perform the duties adequately. Critical areas of knowledge can also be identified by observing the characteristic differences in job performance among the most competent workers and of the least efficient.

Some companies may find it desirable to maintain a dual filing system, one set of cards for regular use in assembling job analysis information, and one set of cards as a permanent file to facilitate ready location of any particular job analysis item, whether active or inactive, on which information may be needed.

Once the questionnaire is ready for distribution to employes, the decision has to be reached as to which employes in your company will be included in the job analysis-classification plan. Should you include department heads and assistants?

It is usually desirable for a job analysis questionnaire to include pertinent points such as those which follow: Job title, number employed at time of analysis, code number, date on which analysis was made, alternative title, work performed and specific nature, experience, performance requirements, characteristics required of the worker, etc.

Preferably, the points to be covered in the job analysis-classification sheet should be worked out by the personnel department. In fact, it is essential if pitfalls are to be avoided.

JOB EVALUATION

What It Is. Assuming that your management has adopted the procedures and methodology to be employed in the job analysis plan, the next step is to decide how good your present method of determining relative base money rates are and then to install one of the four basic job evaluation systems now in use.

Actually, job evaluation provides a working tool to appraise the employe's performance and provide information necessary to gain the highest quality and efficiency of every worker. It can bring some order out of the haphazard assigning of prevailing wage rates.

Job evaluation is not new. However, the first scientific plan for the study of jobs and wage relationships was advanced in 1881, by Frederick W. Taylor, who made time studies and analyzed jobs into units and duties. The analysis consisted largely of a listing of the steps needed for production and the time necessary for each step, so as to accumulate a standard time for the production or work performance of a single unit. Out of this practical approach arose the many incentive wage payment plans which we find in evidence today.

Employers generally favor the use and installation of job evaluation because they are assured of a relatively stable unit labor cost and greater employe efficiency. It is unfair to pay the same wage to a slow worker as to a more efficient one, and a system which rewards the individual worker according to his skill and industry based upon scientific study is therefore both more equitable and more desirable.

What It Comprises. There are four types of job evaluation systems:

1. The Ranking System. This is sometimes referred to as the card-sorting system, because the jobs are arranged from high to low, as in the cards of a playing-card deck. All the jobs are ranked in order of importance—that is, in terms of other jobs, not in terms of money, and without reference to the person holding down the job. The best method is to list the jobs in each department on a separate sheet, horizontally, and have the department heads arrange them vertically, in order of importance. The individual department lists are then combined into one organizational chart. With this type of ranking, it is essential to check and double-check with the various departments to avoid disagreement.

2. Job Classification System. Under this system, a number of categories or grades are established in advance, and the jobs are assigned to these classifications. Such a method presupposes that every job in your company contains definite elements or phases that can be classified into grades. The grades are then established on the basis of difficulty and responsibility, as represented by the number and kinds of rules regulating the work being done, and by whether or not, and how often the work is subject to check. The success of such a job-measuring stick depends on a thorough knowledge of all the jobs, so that every work element may be taken into consideration, and the duties and responsibilities of every worker clearly distinguished.

3. The Point System. This method is the most widely used today. Moreover, it is rapidly gaining still greater acceptance by American industry. Briefly, it works something like this:

A number of predetermined factors —such as age, education, years of training, experience needed, physical effort involved, etc.—are found to be common in all jobs. A schedule of points is then set up for the various gradations of each factor. Each level must be strictly defined, so that consistent interpretations of the elements included in each factor may be made. The levels or grades in each factor should be expressed or defined in written form, and it is also desirable to have each definition accompanied by examples of standard or well-defined jobs that have taken into consideration the following:

- The minimum ability which an employe brings to the job.
- Extent to which he is called upon to use his abilities.
- Responsibilities which the employer demands on the job.
- Conditions under which the job must be performed.

When the individual jobs have been evaluated the sum of the job factors should be well under the maximum total points of the system.

4. Factor Comparison System. There are several differences between this method and the point system. One is that the graded factors are assumed to be fundamental to all jobs. Another is that jobs are evaluated relatively, using certain existing jobs as points or degrees on the evaluation scale, rather than descriptive definitions.

This system has the advantages of simplicity and of establishing a fixed relationship between job value and actual compensation, since it is based on key jobs for which compensation

Industry is using four types of job evaluation systems:

1. POINT SYSTEM: This is the most widely used method and it is rapidly gaining even greater acceptance in American industry.

2. RANKING SYSTEM: With this system it is essential to check and double-check with the various departments to avoid disagreement.

3. JOB CLASSIFICATION: The success of this method depends on a thorough knowledge of all jobs, so that every work element may be taken into consideration, and the duties and responsibilities of every worker clearly distinguished.

4. FACTOR COMPARISON: This system has the advantages of simplicity and of establishing a fixed relationship between job value and actual compensation.

are you pumping red tape?

If you are there's no quick, easy solution to your problem. But an answer must be found. The red tape of oil operation can choke production as surely as a well that is sanding up. These higher operation costs can cut your profit to the point that you are working only for your creditors.

Although you have no control over your sales price, you can control your costs. Working with your legal and tax counsel, The Commerce can analyze your costs, find where economies can be effected, thereby increasing the profitableness of your operation by helping you to cut your costs. Your income goes up when you stop pumping red tape.

Facilities of The National Bank of Commerce Oil Loan Department are available in Wyoming, Nebraska, Colorado, New Mexico, Texas, Louisiana, and Mississippi.

E. O. Buck, vice president, Oil Loan Department

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

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Gulf Building, Houston, Texas

is standard or, at any rate, not subject to controversy.

Once the key jobs have been selected, they are ranked from highest to lowest in order of importance. After the ranking, however, the key jobs are evaluated by study and examination of individual job descriptions. All other jobs are then related to the key jobs, and the final result is an agreed-upon, company-wide grading system.

The important thing to remember in any job evaluation plan is that it must not become mechanical, but should be checked periodically to determine how effectively it is being administered. This is especially true in the oil industry, where competition among firms for skilled workers is high, and where tradition and precedent are of the utmost importance in raising employe efficiency, solving wage demands and good industrial relations. —**The End**

Have You Forgotten Something?

The 1957 Editorial Index of all 14 issues of WORLD OIL is now being mailed to subscribers requesting a copy. This convenient index covers all editorial matter published last year, by author and by subject.

It's bound in pamphlet form for ready reference to a year of "must" reading. To get your copy, merely drop a request to Librarian, Gulf Publishing Company, Post Office Box 2608, Houston 1, Texas. Or if you prefer, use the blue Reader's Service Postcard in the back of this and every issue of WORLD OIL. Merely check the "index" square on the postage-paid postcard.

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If Oil Could Speak

If oil could speak it would have many fascinating truths to tell the non-oil public—truths that would win thousands of new friends for the oil industry.

But, oil can't speak—you can. You, as an individual, can win many new friends for the oil industry if you will pass the true facts on to your non-oil industry friends.

Here are some of those true facts. They are being presented for one purpose: To keep you posted on your industry, so you can tell the story oil is unable to relate.

Read these facts. You will find them informative—and interesting.

"If Oil Could Speak" it would tell the American public:

What Part Does Oil Play in Railroading?

Ask any railroader what motivates his work and probably nine times out of ten his answer will be "oil." Today more than 26,000 oil-burning diesels have replaced almost 90 percent of the old-fashioned steam locomotives operating ten years ago, at a great economy in fuel. On the average, one diesel has been able to replace two or three steam engines. Oil fueled diesels transported an estimated 650 billion net ton miles of goods last year, consumer well over 3½ billion gallons of diesel fuels.

What Does It Cost to Increase Gasoline Quality?

American motorists like luxury travel—and the powerful, high compression cars they demand need top quality, high octane gasolines. According to one estimate, by 1958 it will take a fuel of about 95 octane to get top performance out of 90 percent of the cars on the road. And if present trends continue, high performance cars may require 110 octane gasolines by 1960. This is an expensive proposition when you consider that it costs the oil industry about $100 million to increase the national average gasoline octane rating by just one point.

Is Oil Getting Harder and More Expensive to Find?

Drake's well, which marked the commercial discovery of oil in 1859, produced from a depth of 69½ feet. Today the deepest production is from rock 20,741 feet deep in the earth. Cost to drill: $2.5 million or $110 a foot. Every year oil men have to drill deeper to find oil, and there's no peak cost in sight. One company has estimated there will be an 1100 percent increase in wells drilled 18,000 feet and deeper in California and the Gulf Coast—from seven in 1956 to 82 in 1965. Cost will soar skyward as the wells sink deeper.

How Do You Find Oil?

Oil men will go to any lengths to find the elusive mineral. One oil company uses a unique mountain-building machine to reconstruct the earth on a miniature scale. Sheets of rubber and clay representing rock layers are placed in a box with hinged sides that allow its deformation. By applying pressure to the sides of the box, folds equivalent to hills and mountains can be formed in the clay and rubber layers. Using this machine, scientists hope to get a clearer picture of how and where oil traps are formed in mountain areas.

Does the Oil Industry Pay Its Share of Taxes?

Taxes and fees collected directly from the oil and gas industry or the product it sells, account for more than half the income derived by the State of Louisiana from state sources. During the last six-year period for which comparative figures are available, severance taxes paid to the state for the privilege of taking natural resources from the ground provided Louisiana with $383,383,900 in revenue, compared with $22,425,343 from all local sources.

Expected Business Recovery Brightens Oil Outlook

• It is hoped that 1958 will bring better demand for oils, firmer markets and prices, more profits.

• Excess inventories are being worked off with aid of strict control of crude production and imports.

By L. J. Logan, WORLD OIL Staff

THE PETROLEUM industry of the U. S. faces further lagging of business in the first half of 1958, as in the latter part of 1957, because of the general business letdown.

But there is widening confidence that the latter half of this year will bring better trends of demand for oils, firmer markets and prices, and more profitable operations.

The growing confidence is beginning to spread also into related industries, including equipment suppliers and service concerns. Heretofore, there were predictions of fewer wells but more footage to be drilled in the U. S. in 1958. But now there are some large equipment suppliers expecting increases in both wells and footage. One supplier predicted 56,000 wells, compared with 54,000 in 1957, and 235 million feet of hole, against 225 million.

Numerous economists in the petroleum industry, other industries, and government believe that the present business contraction will not be severe or prolonged. They predict that a healthy recovery will be under way before the end of 1958. In forecasting oil demand for 1958, the U. S. Bureau of Mines has assumed that there will be a business improvement from present levels in the fourth quarter.

Stocks Less Excessive. Stocks of crude oil and refined products became burdensome in the latter half of 1957, with both domestic and export demand lagging. Prices of gasoline and other products weakened. There were some regional reductions in crude oil prices. But in recent months the stocks of crude and products gradually have been brought within more desirable proportions.

Contributing greatly toward this success have been: (1) the strict crude production allowables ordered by the state conservation agencies since mid-year 1957, and (2) the voluntary curtailment of imports sponsored by the U. S. government since last fall. Also helping to balance supply and demand currently is the seasonally heavy consumption of fuel oils. Now it is rather widely hoped that there will be a continuance of effective balancing of petroleum supply with demand throughout 1958.

Demand for Oil. Past and prospective trends of petroleum demand have been indicated by the U. S. Bureau of Mines in its forecast of supply and demand for 1958. The bureau forecasts that total demand for all oils will average 9,369,000 barrels daily in 1958, virtually the same as in 1957. There was a subnormal increase of 1.7 percent in 1957 over 1956.

Exports will be down sharply in 1958 from 1957, when they were up abnormally because of the Suez crisis. Offsetting the drop in exports in 1958, however, there is forecast a 2.5 percent increase in domestic demand for all oils. These conditions would be a reversal of those in 1957, when a jump in exports was accompanied by lagging domestic consumption, which showed only a nominal gain of 0.3 percent.

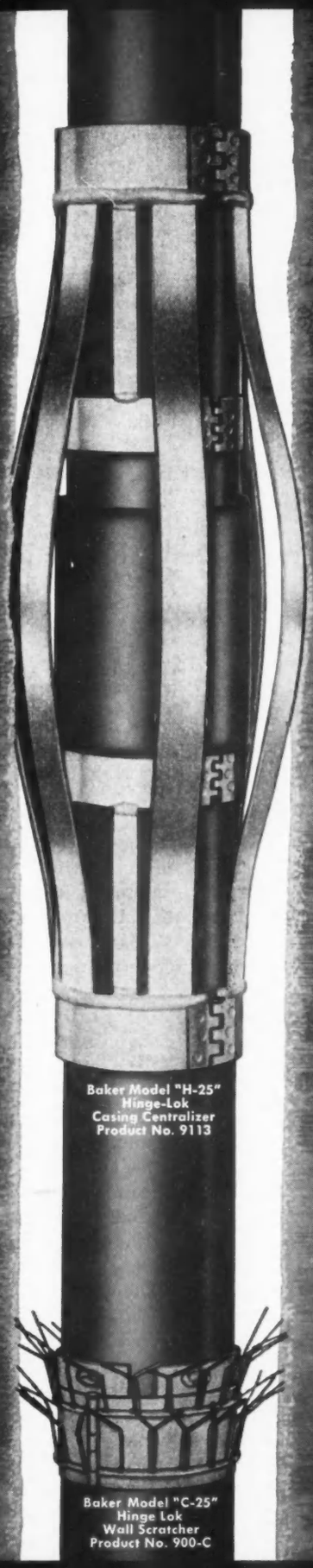
While total demand for all oils will change little in 1958, the demand for gasoline, the industry's principal "money crop," will be up 1.8 percent, the same gain as in 1957.

With total demand unchanged, the Bureau of Mines also estimates crude runs to stills unchanged in 1958 at 7,927,000 barrels daily. In 1957 the runs had been down nominally from 7,937,000 daily in 1956.

Less New Supply Needed. As it is expected that total demand will be unchanged and that a limited part of it will be met from ample product stocks, new supply of oils required will be 1.5 percent less in 1958 than in 1957. Domestic production of natural gas liquids probably will increase 1.9 percent. But total imports will be down 1.9 percent if the government quotas are observed. In these circumstances the required domestic production of crude will average 7,037,000 barrels daily in 1958, a decrease of 1.8 percent from the 7,169,000 daily of 1957 and 1.6 percent less than the 7,151,000 of 1956.

Foreign Use Increasing. In the free world outside the U. S., oil demand increased by an estimated 6 to 8 percent in 1957 over 1956. A further increase of about 8 to 10 percent is forecast for 1958. Those increases are appreciably lower than for other recent years. But they are substantial and favorable for world oil markets.

Better Earnings Promised. The petroleum industry is among the few that are promised in 1958 an upturn in revenues and profits and scattered dividend increases, in the opinion of the Value Line Investment Survey, published by Arnold Bernhard & Company, New York investment advisers. Excess oil inventories will be worked off, the survey predicted, through restraint on imports and domestic production and with benefit of a small increase in demand for petroleum products. Currently weak products prices consequently should become firmer, the survey concluded, and the pressure on profit margins should ease. —The End



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BAKER

WALL SCRATCHERS
CASING CENTRALIZERS

Facts the Banker Needs In Making Oil Loan

• Better understanding of bank's requirements will make it easier for an operator to obtain his loan.

• Reports submitted by operator and his engineer should include information that the bank must have.

By C. R. Dodson, Assistant Vice President,
Petroleum Department, The First City National Bank, New York, N. Y.

FUNDAMENTALLY, THE credit analysis for term loans on oil and gas production does not present any really new problems to banks. But there are some aspects to oil and gas loans requiring experience and judgment which have not been available in most banks until recent years. In addition, the oil operator does not always understand or appreciate "banking." Nor is his engineer or independent engineering consultant fully aware of bank requirements. Consequently, in order to improve relations, make sound loans, adequately serve customers and avoid foreseeable difficulties, it is essential that banks explain their requirements and be sure the reasons are clearly understood.

Oil and gas loans are generally term loans; that is, loans that take longer than one year to pay off. They are often secured by a first mortgage on the oil and gas properties, and are amortized monthly by the income from production, usually by an assignment or order on the buyers.

There are two classes of loans; the production loan, such as an operator would make to obtain funds to carry on his development program, and the oil payment or A-B-C type. The latter usually results from sales of properties, year-end tax situations, or lease drilling and development programs, and is characterized by the feature that the loan is to be repaid solely from the reserved portion of the oil and gas as it is produced.

Elements of a Bank Loan. There are three basic elements in an oil and gas bank loan:

1. The credit standing of the borrower who may, or may not, be the operator of the properties; if not, then the operator's integrity and ability also is a factor.

2. The engineering report.

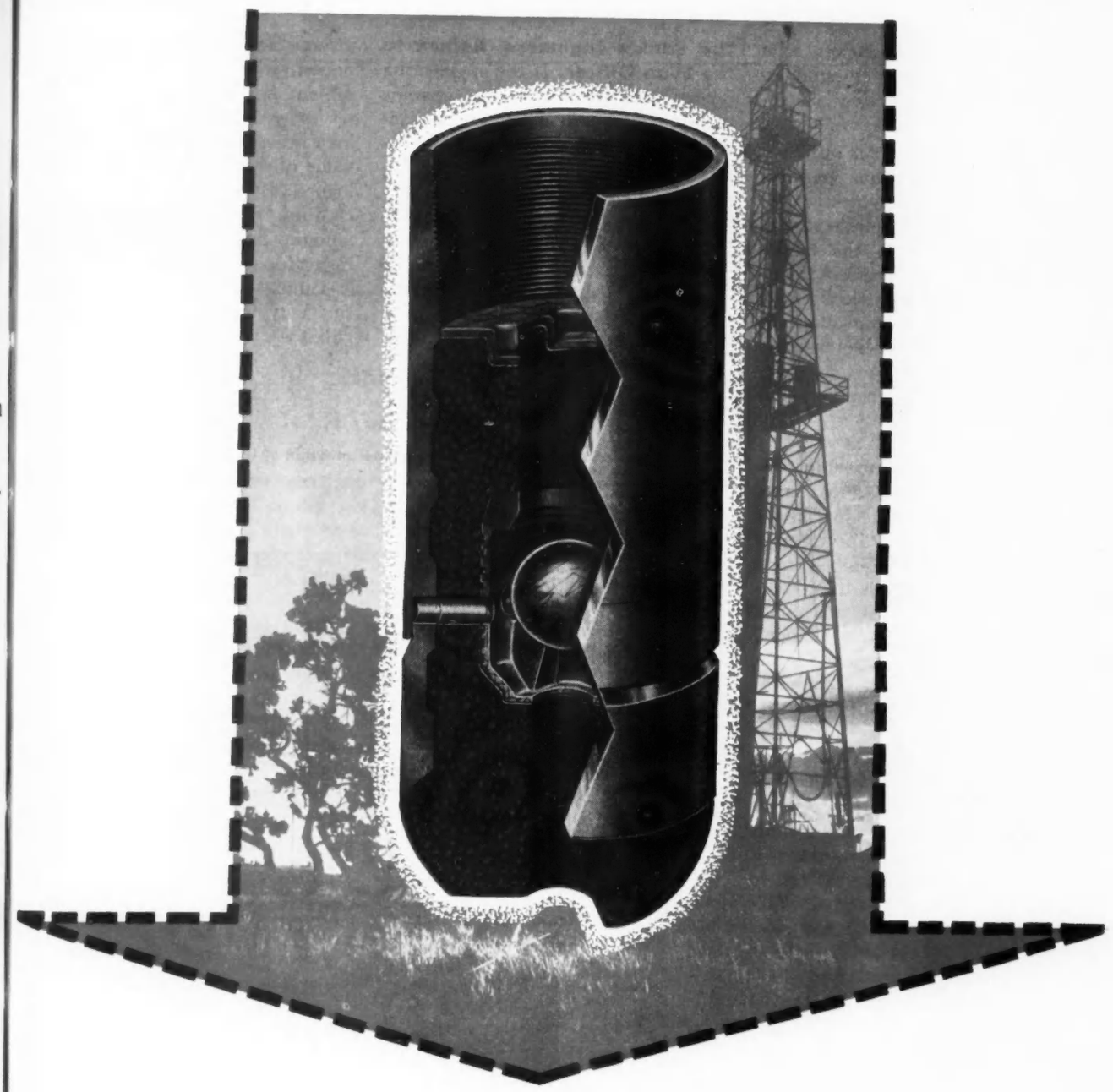
3. The legal documentation required to implement, provide the security and protect the rights of the borrower and the bank. All are important and must be properly analyzed and evaluated to insure sound loans.

Historically, banks are fully experienced and familiar with judging management and preparing the proper legal documents. The borrower's or operator's credit is based primarily on his character, previous bank experience, his "know-how" in oil field practice and ability to efficiently manage his business.

The legal documentation for oil and gas loans varies considerably, depending on the nature of the loan. It usually involves a commitment letter, the indenture or loan agreement, mortgage, deed of trust, note, title opinions, assignments, transfer orders, corporate resolutions and opinions of counsel regarding corporate action, letters by officers or partners regarding debt and other matters and audited statements. In some instances, Internal Revenue Service rulings on tax matters are requested. Certain documents are usually recorded.

The third element, the engineering report, is primarily an appraisal or valuation of the borrower's interest in specified oil and gas reserves which are to be produced in the future and a forecast of the production and the income from sales. The reserves provide the collateral for the loan and the income, the means for interest and amortization by a given date. These reports are usually prepared by independent petroleum engineering consultants who are known and acceptable to the banks.

Oil loans based on oil and gas reserves and future production differ greatly from the usual type of bank loans, since the appraised property, oil and gas reserves, cannot be "seen," counted or insured, and the future production or income cannot be estimated from past company statements of assets, liabilities, income and expenses. Therefore, the services of



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specialists, petroleum engineers, who are experienced in reserves estimates and forecasts of production are required.

Generally, the bank loan officer is not a qualified petroleum engineer and must depend on engineering reports by independent petroleum engineering consultants or the bank's staff of petroleum engineers. A number of banks active in oil loans have staff engineers or retain consultants to assist them. In this article, primary concern is with the reports by independent petroleum engineering consultants.

The Consultant's Engineering Report. Reports submitted to banks have shown a wide range in content and presentation. Some are satisfactory. Others are almost useless to a bank. The majority are partially complete and require much additional work and checking before the bank can accept the results. There are probably many reasons for the incomplete reports. Some may be the fault of the banks. For example, banks may not be clear as to their needs, or may even be reluctant to state their requirements. Since all reports are costly in time, effort, and money, and doubly so if not acceptable or satisfactory, banks should make every effort to minimize any fault on their part. This is particularly true if the reasons are due to omission of certain data, such as well tests, maps, calculations, lease or contract terms, or other pertinent information required by the bank.

Reports have been submitted that were without dates, signatures, the proper classification of reserves, and numerous other obvious factors which should be fundamental to all reports as well as those submitted to a bank. Forecasts of production and net income are sometimes omitted. Sometimes the forecasts are obviously wrong or based on expected increases in price and allowables, which are insupportable. Inexcusable errors are often found in future cost estimates and production rates. This is probably because some consultants are either careless, overly optimistic, or inexperienced in production engineering. Known hazards and unfavorable circumstances are often not even mentioned. Sometimes the reports are so poorly organized that pertinent data are overlooked or cannot be segregated for interpretation.

The Bank's Engineers' Report to the Loan Officer. If the engineering report, subsequent checking, answers to pertinent questions, and other factors relative to bank policy are satisfactory, then the bank petroleum engineers can proceed to test whether the proposed loan will conform to the bank's policy regarding percentage of gross income pledged or required to service the loan, interest rate, minimum principal payments schedule, term, percentage of present future net income remaining at maturity. Also present worth or rate of return, the present fair market value of the reserves by several methods and various loan ratios such as loan to fair market value of security, $/Bbl. or cents/Mcf loaned. If the proposed loan fails to conform, then they will determine the amount that will meet the requirements for a sound loan.

Table 1 shows the pertinent data for a typical production loan of $10,000,000.

TABLE 1

Oil and Gas Loan Engineering Analysis—Determination of Loan Amount Term and Maturity

A. Borrower: Jig Rig Oil Co.
B. Loan requested: $10,000,000
C. Type of Loan requested:
a. Secured production (X), b. Unsecured production ( )
c. Reserved oil payment ( ), Reservation: % of Gross Proceeds
D. Interest Rate: Gross.....%p.a., Bank: 6 %p.a.
E. Recovery to date, Estimated Reserves and Future Income.

1.	Ultimate oil recovery				=	10,220,000 Bbls.
2.	Ultimate gas recovery				=	130,000,000 MCF
3.	Oil recovery to 11/1/56 = 44.7	% of ultimate				
4.	Gas recovery to 11/1/56 = 23	% of ultimate				
5.	Reserves: Oil as of 11/1/56				=	5,640,000 Bbls.
6.	Reserves: Gas as of 11/1/56				=	100,000,000 MCF
7.	Borrower's future gross income.					$37,528,000
8.	Borrower's future net income.					$29,866,000
9.	Average future operating costs as percent of gross income.					20%
10.	Present worth of future net income at 5 %				=	$23,019,000
11.	50% of present worth of future net income at 5 %				=	$11,509,000
12.	Present worth of Pledged or Reserved income at %				= $	
13.	50% of future net income.				= $	
14.	Date to deplete 50% of future net income				=	7/1/6
15.	Time to deplete 50% of future net income					3 Yrs. 8 Mos.
16.	One-third of future gross income				=	$12,509,000

F. Estimated Fair Market Value of Reserves supporting loan.

1.	Actual sales price if any.					= $	None
2.	Based on going unit prices:						
a.	Oil	5,640,000 Bbls.	@ $	1.10	/Bbls.		$6,204,000
b.	Gas	100,000,000 MCF	@	4	¢/MCF		$4,000,000
c.	LPG	246,000,000 Gal.	@	2	¢/Gal.		$4,920,000
d.	Nat. Gaso.	Gal.	@		¢/Gal.	$	
					Total FMV	=	$15,124,000
3.	Based on 50% of present worth of future net income at 5%:				FMV	=	$11,509,000
4.	Based on 4 year payout of investment,				FMV	=	$16,200,000
5.	Based on "East Texas going prices", or ⅔ of present worth at 5% FMV = 0.667 x $23,019,000					=	$15,354,000
6.	Based on B-A and Gulf valuation at 75% present worth of net income at 6% 0.75 x $				FMV	= $	
7.	Based on Terry-Hill method				FMV	= $	
8.	Based on recent sales in subject areas or comparable production				FMV	= $	
9.	Average FMV estimate				FMV	=	$14,547,000
10.	Applicable FMV for subject loan				FMV	=	$11,500,000

G. Estimated loan by engineering method and tests for soundness.

1.	Amount, (Principal) at % of FMV				=	$10,000,000
2.	Estimated term:					2 Yrs. 9 Mos.
3.	Estimated retirement date					8/1/5
4.	Percent of (operator's) net income left at loan paydown					58%
5.	Ratio: Loan to FMV of Pledged properties				=	0.5
6.	Percent of Pledged income left at paydown				=	
7.	Income required to service loan					
a.	Amount (Principal plus interest)				=	$10,778,00
b.	Ratio = Income to service to Income Pledged				=	
8.	Amount loaned:					
a.	Per Barrel of Oil:				=	$0.72 /Bbl
b.	Per MCF of Gas:				=	2.7¢/MCF
c.	Per Gallon of liquids:				=	1.32¢/Gal
9.	Effect on loan by 50% reduction in payments					
a.	Term					9 Yrs. 6 Mos.
b.	Operator's net income at maturity				=	

H. Recommended loan

1.	Amount				=	$10,000,000
2.	Maturity				=	Date 8/1/5
3.	Term				=	2 Yrs. 9 Mos.
4.	Interest rates; Gross %p.a.	Bank:	6	%p.a.		
5.	Ration: Loan to FMV of reserves to service loan				=	0.5

6. Minimum annual principal payment schedule on a cumulative basis:

	Date Due	Payments:	Cumulative
1	6/1/57	$ 2,500,000	$ 2,500,000
2	12/1/57	2,000,000	$ 4,500,000
3	6/1/58	1,750,000	$ 6,250,000
4	12/1/58	1,750,000	$ 8,000,000
5	6/1/59	1,500,000	$ 9,500,000
6	8/1/59	500,000	$10,000,000
7	/ /		
8	/ /		
9	/ /		
10	/ /		
	Total	$10,000,000	

7. Security
a. Mortgage & Deed of Trust on oil and gas properties
b. Assignment of gross or 100% of proceeds

Warren L. Baker, Editorial Director

Large Stock Reductions Improve Outlook

Except for California, the outlook has improved during the last four weeks as a result of sizeable reductions in both distillate fuel and crude stocks.

Encouraging signs of considerable improvement in the U. S. oil inventories took place during the past four weeks, leading to the hope that coming weeks will see additional reductions.

Cold weather boosted heating oil demand sufficiently to cause exceptionally large drafts on distillate stocks. Crude oil stocks continued to decline, especially outside of California. Gasoline continued their seasonal increase, but the rate of growth was slower than in past weeks.

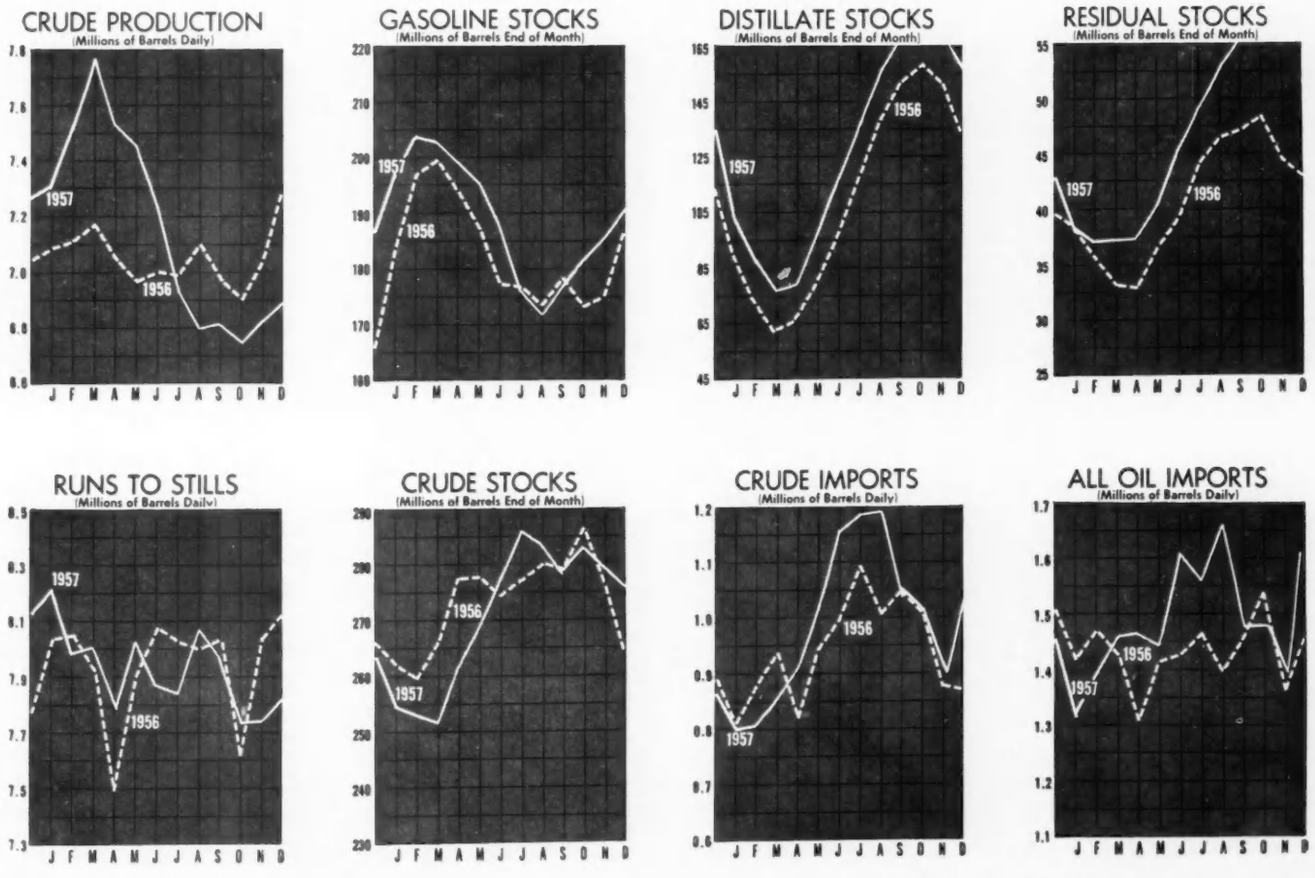
Considerable additional reductions must be made before excessive inventories bring a better balance with demand. This is especially true of refined oil stocks. Therefore, it is important that refiners continue to exercise patience and restraint.

•

Biggest news was the large reductions made in distillate fuel oil stocks. Cold weather in the northern sector of the nation caused 18 million barrels to be taken from storage during the first 17 days of 1958. However, additional reductions are needed to reduce stocks sufficiently to draw off excess quantities now in storage. The northern section of the U. S., therefore, must continue to experience cold weather until at least the end of February, if distillate stocks are to drop to desirable levels before the end of winter.

Distillate fuel oil stocks totaled nearly 135½ million barrels on Jan-

Petroleum Trends . . .



U. S. Crude Production by States

(THOUSANDS OF BARRELS)

STATE or DISTRICT	DAILY AVERAGE PRODUCTION Dec., 1957	Nov., 1957	Dec., 1956	% Diff. Dec., '57-'56	TOTAL PRODUCTION For Year 1957	1956	% Diff. 1957-1956
Alabama	15.6	17.1	11.5	+ 35.7	5,415	3,069	+ 76.4
Arkansas	82.8	81.5	82.4	+ 0.5	30,517	29,355	+ 4.0
California	928.8	926.6	943.8	— 1.6	339,610	350,754	— 3.2
Colorado	143.4	143.8	159.4	— 10.0	54,927	58,516	— 6.1
Florida	1.3	1.3	1.3	.....	460	479	— 4.0
Illinois	239.0	230.3	223.1	+ 7.1	78,279	82,346	— 4.9
Indiana	31.3	32.8	38.1	— 17.8	12,722	11,513	+ 10.5
Kansas	340.1	334.4	333.5	+ 0.3	121,854	124,204	— 1.9
Kentucky	42.6	44.0	49.9	— 14.6	16,780	17,628	— 4.8
Louisiana	838.8	817.2	946.0	— 11.3	323,801	299,421	+ 8.1
North Louisiana	113.6	113.1	131.9	— 13.9	46,076	46,927	— 1.8
South Louisiana	725.2	704.1	814.1	— 10.9	277,715	252,494	+ 10.0
Michigan	27.1	26.7	28.8	— 5.9	10,217	10,740	— 4.9
Mississippi	104.0	98.5	113.5	— 8.4	39,569	40,824	— 3.1
Missouri	0.1	0.1	0.1	.....	58	65	— 10.8
Montana	74.4	74.9	68.2	+ 9.1	27,081	21,760	+ 24.5
Nebraska	55.5	55.4	51.3	+ 8.2	19,362	16,204	+ 19.5
Nevada	0.1	0.1	.....	.....	26	64	— 59.4
New Mexico	262.3	253.8	249.7	+ 5.0	94,287	87,893	+ 7.3
Southeast New Mexico	257.5	249.8	245.2	+ 5.0	92,103	86,479	+ 6.5
Northwest New Mexico	4.8	4.0	4.5	+ 6.7	2,184	1,414	+ 54.5
New York	7.1	7.3	7.5	— 5.3	2,692	2,748	— 2.0
North Dakota	38.4	33.1	41.7	— 7.9	13,544	13,495	+ 0.4
Ohio	16.4	16.3	12.6	+ 30.2	5,112	4,785	+ 6.8
Oklahoma	581.1	566.9	609.5	— 4.7	214,965	215,862	— 0.4
Pennsylvania	19.8	21.3	22.0	— 10.0	8,189	8,230	— 0.5
South Dakota	0.2	0.2	0.1	.....	32	32	.....
Tennessee	0.1	0.1	0.1	.....	7	9	— 42.2
Texas	2,717.5	2,721.0	3,089.1	— 12.0	1,084,733	1,107,808	— 2.1
Dist. 1: South Central	50.2	50.1	56.1	— 10.5	19,464	20,145	— 3.4
Dist. 2: Middle Gulf	130.4	128.9	153.4	— 15.0	52,976	56,891	— 6.9
Dist. 3: Upper Gulf	407.7	407.7	458.0	— 11.0	160,775	165,421	— 2.8
Dist. 4: Lower Gulf	203.5	204.5	236.6	— 14.0	82,567	88,553	— 6.8
Dist. 5: East Central	31.3	32.2	39.8	— 21.4	13,775	16,064	— 14.3
Dist. 6: Northeast	276.1	277.7	341.3	— 19.1	116,849	124,798	— 6.4
Dist. 7-B: North Central	144.2	143.1	159.3	— 9.5	57,342	57,360	— 0.1
Dist. 7-C: West Central	155.0	154.1	170.0	— 8.8	58,469	66,804	— 12.5
Dist. 8: West	1,009.5	1,011.4	1,130.6	— 10.7	400,461	387,096	+ 3.5
Dist. 9: North	205.9	207.4	208.5	— 1.3	76,286	77,228	— 1.2
Dist. 10: Panhandle	103.7	103.6	105.9	— 2.1	38,251	35,857	+ 6.7
Utah	14.1	12.4	7.9	+ 78.5	4,015	2,466	+ 66.5
Virginia	0.1	0.1	.....	.....	10	4	+ 50.0
Washington	.....	.....	.....	.....	1	.....	.....
West Virginia	5.9	6.3	5.3	+ 11.3	2,220	2,179	+ 1.9
Wyoming	306.9	300.7	280.5	+ 9.4	106,982	104,830	+ 2.1
Total United States	6,894.8	6,824.2	7,376.9	— 6.5	2,617,467	2,617,283	.....

Source: Bureau of Mines and API. Texas Districts from API and do not necessarily agree with State totals.

U. S. Crude Oil and Refined Product Trends

(THOUSANDS OF BARRELS)

MONTH	CRUDE OIL Production Daily	Runs to Stills Daily	Stocks End of Month	GASOLINE Production Daily	Stocks End of Month	DISTILLATE FUEL Production Daily	Stocks End of Month	RESIDUAL FUEL Production Daily	Stocks End of Month	DAILY IMPORTS Crude Oil	Total Oils
1956:											
January	7,199	8,023	261,592	3,927	183,905	1,923	86,141	1,344	38,247	805	1,422
February	7,208	8,047	259,504	3,854	196,092	1,918	71,335	1,286	35,675	878	1,472
March	7,278	7,914	265,683	3,829	199,698	1,808	60,846	1,213	32,984	934	1,425
April	7,146	7,487	277,121	3,646	193,299	1,713	63,571	1,130	32,740	815	1,305
May	7,064	7,896	277,497	3,859	186,673	1,667	75,928	1,149	36,607	938	1,416
June	7,100	8,071	274,491	3,976	177,076	1,755	93,758	1,098	39,073	987	1,426
July	7,090	8,014	277,008	3,975	176,536	1,767	115,787	1,066	43,958	1,084	1,463
August	7,195	7,995	279,944	4,037	172,939	1,839	137,905	1,091	46,617	1,001	1,399
September	7,054	8,024	278,791	3,991	177,974	1,845	150,411	1,062	47,342	1,043	1,452
October	6,966	7,608	286,560	3,773	172,798	1,772	158,871	1,082	48,400	1,004	1,541
November	7,139	8,031	275,995	3,913	174,808	1,841	151,517	1,182	44,590	871	1,362
December	7,377	8,141	266,014	4,039	187,271	1,981	133,981	1,288	44,491	873	1,471
1957:											
January	7,480	8,274	256,669	3,991	197,702	2,118	100,572	1,322	38,403	805	1,421
February	7,682	8,088	256,344	3,864	205,270	2,035	85,105	1,270	36,201	780	1,430
March	7,717	8,047	254,911	3,826	206,716	1,861	76,245	1,205	37,371	836	1,464
April	7,541	7,740	265,796	3,770	201,407	1,764	78,743	1,132	37,429	906	1,542
May	7,442	7,992	275,963	3,900	194,770	1,789	98,135	1,103	41,125	1,042	1,558
June	7,107	7,867	284,312	3,984	177,997	1,773	117,364	1,101	45,572	1,147	1,606
July	6,873	7,852	288,241	3,887	177,868	1,750	138,359	1,090	49,621	1,220	1,654
August	6,786	8,092	283,388	4,122	174,031	1,806	159,124	1,089	52,645	1,257	1,695
September	6,887	7,920	280,469	4,099	180,688	1,772	173,269	1,100	58,727	1,042	1,445
October	6,860	7,650	284,517	3,939	180,902	1,705	176,388	1,052	60,025	1,022	1,532
November	6,824	7,717	279,725	3,830	186,027	1,744	166,323	1,066	58,816	892	1,387
December	6,895	7,803	276,561	3,935	190,295	1,874	153,517	1,110	58,191	1,045	1,619
Week Ended:											
1-17-58	6,925	7,675	*276,737	3,818	200,636	1,962	135,406	1,019	57,952	713	1,361
1-18-57	7,431	8,120	*259,657	3,872	191,373	2,120	114,424	1,275	41,009	597	1,029

* Previous week's stocks.

Source: Data for last two months from API; prior monthly data from Bureau of Mines.

uary 17, whereas they had totaled 174¾ million barrels the end of October. However, they were still 21 million barrels greater than at the corresponding period 12 months before.

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Much improvement also took place in crude oil inventories. Total U. S. stocks of crude oil amounted to 276¾ million barrels on January 11, a decrease of 2½ million barrels during the last four weeks, and a drop of 6¼ million barrels since November 1.

The decline in total U. S. crude oil stocks has occurred despite a sharp growth in California crude inventories. Stocks of California crude oil rose slightly over 2 million barrels during the last four weeks, while stocks elsewhere were dropping 4½ million barrels.

Practically all the decrease of the past four weeks occurred in stocks of Texas crude oil. Texas inventories dropped almost 4½ million barrels. Stocks of Oklahoma crude oil declined 1⅔ million barrels during the last four weeks. There were minor increases and decreases in other sectors, with the Rocky Mountain region showing the largest gains with a growth of slightly more than 1 million barrels in the last four weeks.

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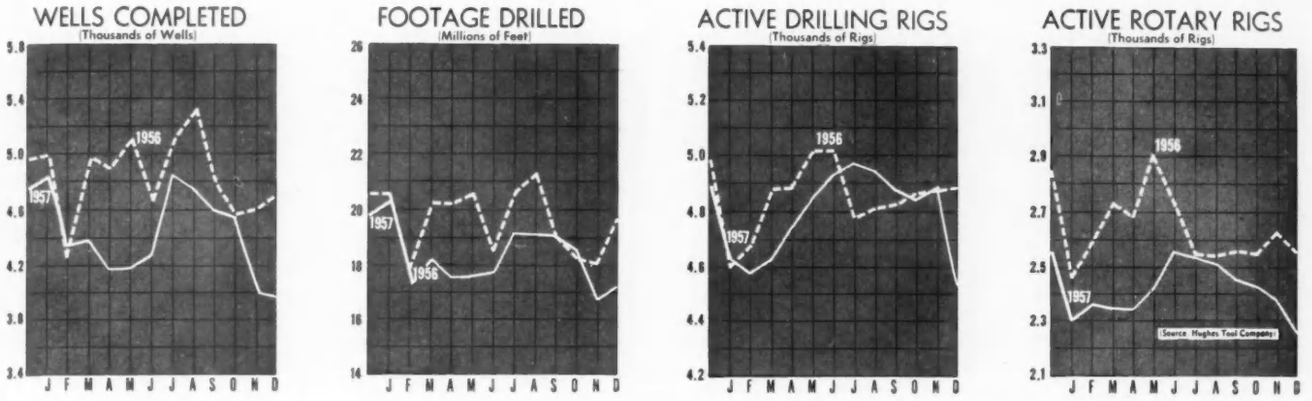
The chief worry at the moment is the high level of gasoline stocks, although additional reductions must be made in distillate stocks before the end of winter weather.

U. S. stocks of gasoline totaled 200⅔ million barrels on January 17. This represented some improvement, in that they were only 9¼ million barrels larger than 12 months before while four weeks earlier they had been 11¾ million barrels greater than a year ago.

A better picture of the gasoline situation is obtained if the growth in California stocks is taken into consideration. California stocks have risen almost as much during the past year as inventories in all the rest of the nation. California gasoline inventories are 4¼ million barrels above last year, the rest of the nation has had a 5-million barrel gain.

Therefore, as with crude oil, conditions are better outside of California than they are in the West Coast state.

Drilling Activities . . .



'57 Wells off 8.7% but Year Still Third Highest Ever

By Cecil W. Smith, WORLD OIL Staff

THE YEAR JUST completed was the first since 1949 in which the U. S. petroleum industry failed to drill more wells than it had the year before. Prior to that, it had also happened back in 1942 and 1943, right after the nation was plunged into war.

In comparison with record-breaking 1956, 1957 was a disappointing year, but still it was the third greatest drilling year in history. At the outset, it looked as if 1957 would surpass the previous period's peak and reach almost to the never-attained 60,000 new wells in a single year. But that was not to be, and it began to become fairly evident as soon as the first several months' records were completed. Apparently, the forces that depressed last year's drilling activity were exerting pressures as early as the end of the third quarter of 1956. However, they were then intermingled with tubular goods shortages that resulted from the earlier steel strike and were not discernible.

Despite the failure to reach new peaks, or even hold the pace, 1957 was still a busy period when stacked up against past years. Its 53,350 new wells topped, by a substantial margin, the best that could be done in any year prior to 1955. It was as late as four years ago that the industry was hoping to be able to hit the then charmed level of 50,000 new wells in a single year.

The 53,350 new U. S. wells drilled in 1957 failed by 8.7 percent of matching the all-time high of 58,418 recorded in 1956. However, this annual drilling volume was bested only twice during the history of the U. S. industry. As late as 1954, 1957's operations would have been acclaimed as gigantic.

The record shows that the last half of the year was responsible for some recovery. However, in comparison with 1956's activity this was true, but the reason for this was not increased operations in latter 1957, but rather the decrease in volume in the last half of 1956, the comparison year. At mid-1957, drilling was trailing almost 10 percent, and finally ended only 8.7 percent behind. But it must be remembered that activity was substantially reduced starting with September, 1956, putting the final four months of that year far off the pace set in the first three quarters. That explains the apparent partial recovery made in the last half of 1957.

There was one drilling record set in the otherwise almost record-devoid year, and that was the average depth of each well drilled. This, of course, made the year's footage-drilled total compare more favorably with the 1956 record. The 219.4 million feet drilled in 1957 was 6.8 percent less than the 235.4 million feet cut in 1956. This 6.8 percent deficiency was made with 8.7 percent fewer wells.

The national well depth average reached the new peak of 4113 feet. A year earlier the average had been 4,029 feet, and the previous all-time high had been 4,090 feet in 1955.

Of the top five drilling states, Texas, Oklahoma, Kansas, Louisiana and Illinois, none showed an increase in number of wells in 1957, but Louisiana and Kansas saw them drilled deeper.

Summary of U. S. Drilling Activity

ITEM	Dec., 1957	Nov., 1957	YEAR 1957	YEAR 1956	Percent Diff.
New Wells Completed:					
Oil	1,862	1,910	27,364	30,641	— 10.7
Distillate	67	65	748	551	+ 35.8
Gas	295	295	3,727	3,944	— 5.5
Service	97	112	1,095	1,028	+ 6.5
Dry	1,653	1,585	20,416	22,254	— 8.3
Total Wells	**3,974**	**3,967**	**53,350**	**58,418**	**— 8.7**
Footage Drilled (Mln. of Feet)	**17.3**	**16.7**	**219.4**	**235.4**	**— 6.8**

Summary of U. S. Wildcat Drilling

ITEM	Dec., 1957	Nov., 1957	YEAR 1957	YEAR 1956	Percent Diff.
New Field Discoveries:					
Oil	39	77	843	1,070	— 21.2
Distillate	7	5	120	110	+ 9.1
Gas	19	25	239	258	— 7.4
Total Discoveries	**65**	**107**	**1,202**	**1,438**	**— 16.4**
Dry Wildcats	865	793	10,181	11,186	— 9.0
Total Wildcats	**930**	**900**	**11,383**	**12,624**	**— 9.8**
Percent Productive	7.0	11.9	10.6	11.4	.....
Percent Dry	93.0	88.1	89.4	88.6	.....

Details on Page 42

U. S. Drilling Activity in December and Years, 1957-1956

STATE or DISTRICT	TOTAL NEW WELLS COMPLETED AND FOOTAGE DRILLED: DETAILS FOR DECEMBER, 1957 — Oil	Dist.	Gas	Dry	Service Wells	TOTAL NEW WELLS — Dec., 1957	Nov., 1957	Dec., 1956	Total Footage Dec., 1957	DETAILS FOR YEAR — NEW WELLS — 1957	1956	Percent Diff.	FOOTAGE — 1957	1956
Alabama	3	....	....	3	....	6	5	3	63,282	94	90	+ 4.4	790,240	769,685
Arizona	....	....	....	....	....	2	7	—	—	7	—	— 71.4	4,505	22,048
Arkansas	41	....	3	42	....	86	80	107	284,275	1,104	1,025	— 7.7	3,371,923	3,055,699
California	132	....	7	64	2	205	199	207	873,085	2,253	2,201	+ 2.4	9,678,046	10,030,280
Colorado	15	1	9	45	....	70	71	101	359,146	815	1,265	— 35.6	4,267,074	6,511,406
Florida	....	....	....	1	....	1	....	1	4,650	9	14	— 35.7	61,732	94,819
Georgia	....	....	....	....	....	....	....	....	....	5	7	— 28.6	25,712	30,149
Idaho	....	....	....	....	....	....	....	....	....	1	5	— 80.0	3,947	19,534
Illinois	41	....	5	78	....	124	263	235	271,592	2,590	3,650	— 29.1	5,928,958	8,403,053
Indiana	16	....	5	46	2	69	72	58	113,163	718	707	+ 1.6	1,211,411	1,230,690
Kansas	191	....	31	174	13	409	326	355	1,495,841	4,222	4,643	— 9.1	14,995,879	16,448,860
Kentucky	40	....	12	66	2	120	162	149	161,882	1,763	2,009	— 12.3	2,541,186	3,010,923
Louisiana	116	22	16	137	....	291	290	393	2,299,958	3,772	3,803	— 0.8	29,746,194	27,985,517
North Louisiana	48	3	6	56	....	113	110	144	469,752	1,433	1,651	— 13.2	5,234,383	5,990,513
South Louisiana	68	19	10	81	....	178	180	249	1,830,206	2,339	2,152	+ 8.9	24,511,811	21,995,004
* Gulf of Mexico	25	3	3	14	....	45	49	52	428,238	648	446	+ 45.3	6,176,558	4,263,784
Maryland	....	....	....	....	....	....	....	....	....	3	4	— 25.0	16,500	30,716
Michigan	22	....	1	29	....	52	30	40	125,672	419	438	— 4.3	1,196,801	1,268,400
Mississippi	10	2	1	17	....	30	39	40	238,218	390	435	— 10.4	2,897,555	3,145,761
Missouri	....	....	....	....	....	....	1	....	....	10	25	— 60.0	7,647	27,153
Montana	12	....	1	24	....	37	48	40	230,542	429	503	— 14.7	2,143,462	2,490,947
Nebraska	19	....	....	56	....	75	65	47	453,833	893	888	+ 0.6	5,297,998	5,147,753
Nevada	....	....	....	....	....	....	....	....	....	5	6	— 16.7	11,260	36,613
New Mexico	70	1	30	44	....	145	167	150	711,505	2,192	1,967	+ 11.4	10,354,453	8,744,835
New York	21	....	1	2	24	48	48	45	69,900	519	492	+ 5.5	813,500	768,136
North Dakota	23	....	....	26	....	49	26	24	330,267	312	280	+ 11.4	2,120,326	2,078,821
Ohio	44	....	11	18	....	73	101	86	171,529	1,011	1,026	— 1.5	2,423,755	2,461,960
Oklahoma	135	4	30	120	10	299	247	503	1,233,698	5,663	7,642	— 25.9	19,419,287	27,135,586
Oregon	....	....	....	....	....	....	....	....	....	3	1	+200.0	19,396	12,880
Pennsylvania	35	....	31	9	34	109	95	91	295,921	1,022	1,047	— 2.4	2,649,658	2,446,017
South Dakota	....	....	....	....	....	....	2	1	....	41	21	+ 95.2	140,675	71,164
Tennessee	....	....	....	....	....	....	....	....	....	20	22	— 9.1	31,000	34,412
Texas	819	37	67	577	10	1,510	1,471	1,839	6,799,316	21,290	22,361	— 4.8	90,102,965	95,021,813
Dist. 1: South Central	34	2	2	46	....	84	74	131	219,471	1,255	1,994	— 37.1	3,253,106	5,084,305
Dist. 2: Middle Gulf	14	6	10	22	....	52	55	64	316,806	760	814	— 6.6	4,607,353	5,007,110
Dist. 3: Upper Gulf	43	4	12	58	....	117	122	156	723,442	1,644	1,827	— 10.0	10,763,881	12,541,644
* Gulf of Mexico	....	....	....	....	....	....	1	4	....	10	20	— 50.0	76,651	196,685
Dist. 4: Lower Gulf-S.W	31	12	8	72	....	123	91	117	676,223	1,426	1,450	— 1.7	7,531,685	7,565,442
* Gulf of Mexico	....	....	....	2	....	2	1	2	22,805	22	13	+ 69.0	216,750	111,841
Dist. 5: East Central	1	1	2	23	....	27	10	* 16	86,512	180	241	— 25.3	775,682	868,129
Dist. 6: Northeast	40	1	6	39	....	86	72	110	483,888	1,069	964	+ 10.9	5,811,496	5,173,418
Dist. 7-B: North Central	76	....	2	95	....	173	193	261	558,393	2,664	3,024	— 11.9	8,847,789	10,721,046
Dist. 7-C: West Central	47	....	....	20	1	68	89	84	349,502	1,155	1,128	— 6.0	5,396,822	5,600,837
Dist. 8: West	340	1	5	87	5	438	396	430	2,201,764	5,047	4,364	+ 15.7	24,723,460	22,470,236
Dist. 9: North	122	5	6	96	4	233	266	366	730,257	4,640	5,058	— 8.3	12,490,756	14,453,187
Dist. 10: Panhandle	71	5	14	19	....	109	103	104	453,058	1,450	1,397	+ 3.8	5,900,935	5,536,459
Utah	26	....	....	10	....	36	36	12	197,675	285	146	+ 95.2	1,563,758	694,502
Virginia	....	....	....	....	....	....	....	....	....	15	21	— 28.6	65,000	95,100
Washington	....	....	....	....	....	....	....	....	....	4	5	— 20.0	20,459	32,338
West Virginia	6	....	30	21	....	57	55	63	155,923	663	698	— 5.0	1,817,230	1,902,460
Wyoming	25	....	4	44	....	73	68	132	353,427	813	964	— 15.7	3,664,736	4,126,411
Total United States	1,862	67	295	1,653	97	3,974	3,967	4,722	17,294,300	53,350	58,418	— 8.7	219,404,228	235,386,441
Total Western Canada	118	....	11	46	4	179	289	308	848,985	2,993	3,391	— 11.7	13,968,509	15,869,656

STATE or DISTRICT	WILDCAT DRILLING IN DECEMBER AND YEARS, 1957-1956: DETAILS FOR DEC., 1957 — Oil	Dist.	Gas	Dry	Total Wildcats	DETAILS FOR YEAR — Oil	Dist.	Gas	Dry	TOTAL WILDCATS — 1957	1956	DRILLING RIGS IN OPERATION (Rigging up, Drilling, Temp. Shut-Down) — Dec. 31, 1957	Nov. 30, 1957	Dec. 31, 1956
Alabama	....	....	....	3	3	....	....	1	40	41	27	11	12	25
Arizona	....	....	....	....	....	....	....	....	2	2	7	5	4	1
Arkansas	....	....	....	1	1	....	....	1	172	184	151	46	62	80
California	1	....	....	21	23	11	....	1	172	184	151	46	62	80
Colorado	1	....	....	41	42	9	....	4	366	379	293	168	174	208
Florida	2	1	2	33	38	22	2	16	443	483	695	56	65	67
Georgia	....	....	....	1	1	....	....	....	9	9	14	1	2	2
Idaho	....	....	....	....	....	....	....	....	5	5	7	....	....	1
Illinois	1	....	....	30	31	15	....	1	720	736	959	268	260	232
Indiana	....	....	....	18	18	1	....	....	168	169	184	117	115	100
Kansas	4	....	1	89	94	112	....	25	868	1,005	1,213	515	575	553
Kentucky	....	....	1	4	5	17	....	1	99	117	172	86	116	110
Louisiana	2	4	....	47	53	39	38	14	546	637	678	381	399	424
North Louisiana	2	....	....	22	24	16	2	3	180	201	230	82	81	69
South Louisiana	....	4	....	25	29	23	36	11	366	436	448	299	318	355
* Gulf of Mexico	....	....	....	3	3	7	5	3	54	69	70	69	74	89
Maryland	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Michigan	3	....	....	17	20	13	....	1	136	150	159	66	69	69
Mississippi	....	....	....	10	10	10	1	....	177	188	205	44	47	32
Missouri	....	....	....	....	....	....	....	....	10	10	16	....	....	1
Montana	....	....	1	19	20	4	....	5	163	172	207	42	49	46
Nebraska	2	....	....	31	33	37	....	2	412	451	427	27	31	31
Nevada	....	....	....	....	....	....	....	....	5	5	4	1	1	3
New Mexico	....	....	....	22	22	45	2	9	241	297	284	175	174	173
New York	....	....	....	....	....	....	....	....	....	....	14	46	68	68
North Dakota	4	....	....	24	28	22	....	....	126	148	84	45	48	26
Ohio	....	....	....	....	....	1	....	....	8	9	3	203	222	205
Oklahoma	2	1	3	32	38	68	9	28	554	659	814	585	622	570
Oregon	....	....	....	....	....	....	....	....	3	3	1	1	1	....
Pennsylvania	....	....	....	....	....	....	....	26	13	39	14	140	187	184
South Dakota	....	....	....	....	....	....	....	....	39	39	20	2	2	6
Tennessee	....	....	....	....	....	....	....	....	....	....	21	....	....	....
Texas	17	1	8	387	413	388	67	80	4,490	5,025	5,546	1,230	1,250	1,347
Dist. 1: South Central	....	....	....	34	34	19	2	3	348	372	575	37	47	46
Dist. 2: Middle Gulf	....	1	1	18	20	5	17	12	232	266	277	36	39	48
Dist. 3: Upper Gulf	1	....	2	29	32	26	13	5	391	435	489	109	106	149
* Gulf of Mexico	....	....	....	....	....	1	....	....	4	5	15	1	1	5
Dist. 4: Lower Gulf-S.W	1	....	....	50	51	20	8	4	331	463	506	77	60	83
* Gulf of Mexico	....	....	....	1	1	....	....	....	4	4	2	1	2	2
Dist. 5: East Central	....	....	1	22	23	3	1	2	127	133	146	11	10	12
Dist. 6: Northeast	1	....	....	30	31	9	2	4	247	262	236	60	59	70
Dist. 7-B: North Central	3	....	1	67	71	97	....	9	900	1,006	1,163	111	121	125
Dist. 7-C: West Central	1	....	....	14	15	38	2	7	278	325	329	77	.82	104
Dist. 8: West	9	....	1	55	65	92	2	6	451	551	526	368	372	344
Dist. 9: North	1	....	2	59	59	67	3	8	978	1,056	1,159	227	233	258
Dist. 10: Panhandle	....	....	....	9	12	12	17	20	107	156	140	117	121	108
Utah	....	....	....	7	7	12	....	3	100	115	92	64	62	38
Virginia	....	....	....	....	....	....	....	....	3	3	5	1	1	....
Washington	....	....	....	1	1	....	....	12	13	25	31	168	175	196
West Virginia	....	....	2	28	30	17	1	10	249	277	272	75	96	86
Wyoming	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Total United States	39	7	19	865	930	843	120	239	10,181	11,383	12,624	4,569	4,889	4,885
Total Western Canada	....	....	....	....	....	....	....	....	....	....	....	177	162	229

* Gulf of Mexico wells are included in their respective district totals

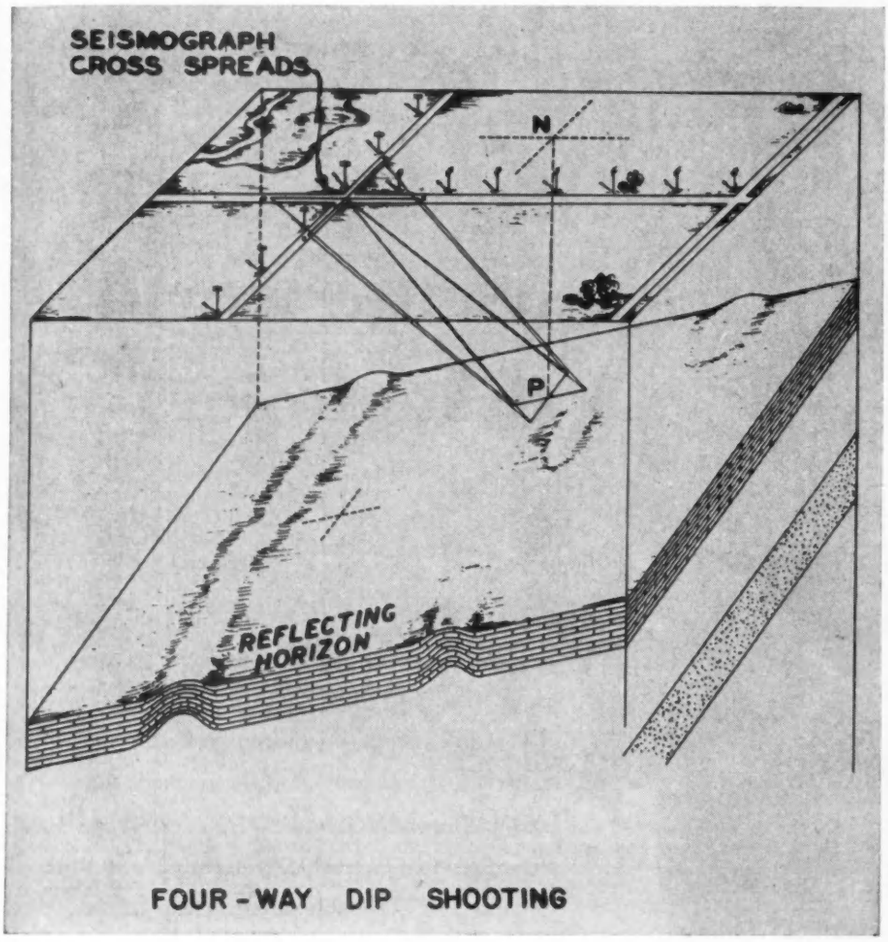


FIGURE 1—The need for dip migration is illustrated in this figure. Seismic cross-spreads are illustrated at the road intersection. The point of reflection for the center of the cross-spreads is at "P" on the reflecting horizon. Proper calculations based on migration principles will yield the drilling depth (NP) required for a well at (N) to reach the reflecting horizon at point (P).

Dip Migration Improves Depth Calculations

This explanation of the proper calculations based on dip migration principles enables a more accurate prediction of the horizon depth.

By W. B. Robinson
Gulf Oil Corporation, Oklahoma City

A CHARGE of dynamite fired in a shot hole, generates shock waves that go in all directions. (Figure 2). There are two useful components of this energy. One is the ray which penetrates to some kind of reflecting horizon, returns to the surface and strikes the detector shown on the surface of the ground. The other useful ray is the one that runs horizontally at a shallow depth and strikes the detector. These fragments of the total energy are used in seismic depth calculations. The horizontal moving energy assists in calculating weathering corrections or adjustments for the changes in the low speed weathered zone at the surface and, the time of the reflection which travels to some depth is used to calculate the depth of the reflecting horizon.

The terms "wave front" and "ray path" are herewith defined. Consider a wave caused by the wind blowing over a wheat field. Each stock of wheat bows as the wind blows across it, but that doesn't mean that one head of wheat goes from one side of the field to the other. It means that each little stock of wheat bows down and comes back to its normal position. The same thing happens in seismic work. When the dynamite is fired it causes each little particle of the earth to go through that same motion of moving forward and then coming back. Consider this wave in Figure 2 as it moves outward in all directions from the shot; assume it could be stopped or photographed at a particular instant of time. If the most forward position of that vibration could

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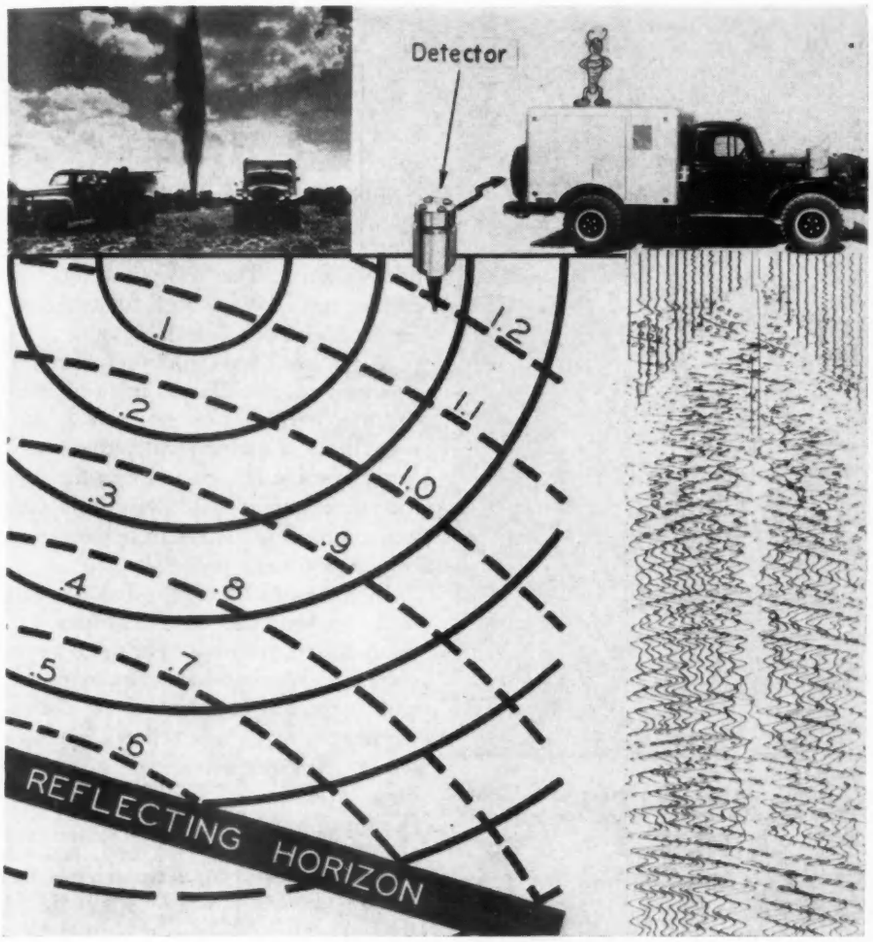


FIGURE 2—This is a representation of the waves generated by the dynamite fired in the shot hole. The shock is transmitted to the reflecting horizon and is reflected back to the detector and is transmitted to the receiving equipment, in the truck shown here, and is recorded.

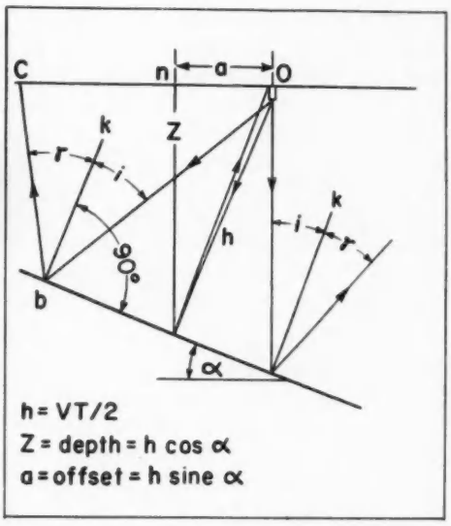


FIGURE 3—The need for dip migration is illustrated here, since the reflection point for the ray returning to the shot point is displaced from a position vertically beneath the shot point, depth values must be corrected accordingly.

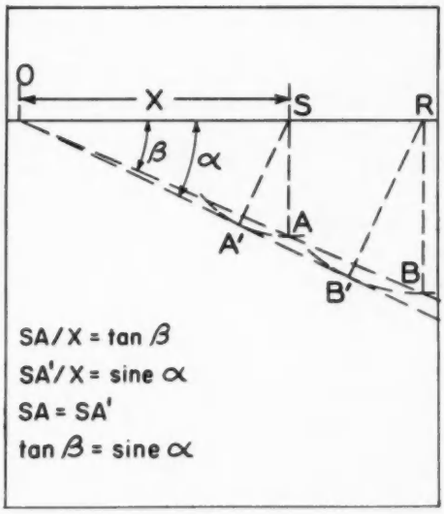


FIGURE 4—Here is shown a graphical illustration of the application of dip migration. If a shot is fired at (S) the velocity of the shock is multiplied by one half the reflecting horizon. If this distance was plotted as line (SA) then (A) would be a point on the reflecting horizon. Since the formation outcrops at (O) some dip is indicated. The line shown as (SA') is the actual reflecting line. The difference between line (OA) and (OA') is the correct and incorrect reflecting horizon.

be mapped at a particular time, that position would constitute a "wave front" and it would be hemispherical. A "ray path" is a figment of the imagination. It is a line drawn always normal to the wave fronts. It represents the path followed by a small amount of the seismic energy as it travels from the shot to the detector. Calculations using geometrical optics can be readily visualized if it is assumed that such a path actually exists and that a particle of energy follows it. The depth of a horizontal reflecting horizon is given by multiplying the average velocity by one-half the corrected reflection time for a detector located near the shot point.

Figure 3, illustrates a geologic horizon dipping at the angle. The shot at "O" will create the advancing wave fronts as before, but only three ray paths are illustrated. A detector at "O" would register the time for the ray which travels down and back on a line (Oh) constructed at right angles to the reflecting horizon and through the shot point. This is the shortest time path for a reflection from the dipping reflector. The distance from "O" to any other point on the reflector is greater than the distance just described. The material above the reflecting horizon is assumed to be of constant velocity (isotropic and homogeneous), and the ray paths are straight lines.

Consider the ray ObC. The line (kb) is constructed at right angles to the reflecting horizon. The angle of incidence (i) is equal to the angle of reflection (r). The point of reflection (b) is not directly below a point on the surface located midway between the shot point and detector. The need for dip migration is illustrated in Figure 3. Since the reflection point for the ray returning to the shotpoint is displaced from a position vertically beneath the shot point the depth values must be corrected accordingly.

How deep a well will have to be drilled to strike this reflecting horizon. As stated earlier, the distance from the shot to the reflecting horizon, (h), is simply the velocity multipied by the time in transit and divided by two because we measure the time down and back. Let us define (a), the offset distance, as the distance between the shot point on the surface and another point (n) on the surface, which is vertically above the reflecting point.

From simple trigonometry it follows that the offset distance (a) is equal to (h), (which is the slant distance to the bed) multiplied by the sine of the angle of dip. The new depth then, that you would measure, if you drilled vertically below (n), would be the depth (Z) and that, of course, is (h) multiplied by the cosine of the angle of dip. Those are the fundamentals with which we must work.

Figure 4 is a graphical illustration of why we must do this offsetting. If a shot is fired at (S), we multiply our velocity by one-half the time and say that is the distance to the bed. If we plotted straight down, as one construction shows, then (A) would be the point at which we would plot our reflecting horizon, but we know that is wrong because the bed has some dip since it outcrops at (O). The dashed construction shows the actual position on the reflecting horizon from which our energy was turned back. So the difference then between the line (OA) and the line (OA′) is the difference between the corrected position of this reflecting horizon and the erroneous or uncorrected position.

In Figure 4 assume that we wish to measure the dip of a bed knowing the reflection times for shotpoints (R) and (S). The bed outcrops at (O). To measure the angle of dip, we start by actually measuring the increase in distance to the bed at two successive shot points. On an unmigrated depth profile, they would appear to be vertical distances. Figure 3 says that we may measure "vertically" the increased "depth" and use the tangent to calculate the angle of dip. This is an easy thing to do on a profile. It is perfectly all right because what you measure as the tangent of dip on an unoffset profile, is in truth, the sine of the true angle of dip. You may go ahead and make your migrations on that basis.

Figure 5 is a small section of a seismograph record showing reflections with considerable dip. We shall use this illustration to define the rate of dip which we shall call Delta T. The term will be used frequently in the work that follows. This is a split spread with a shot at the center. Delta T is the difference in time between traces at opposite ends of the record. The normal move out of angularity, will be cancelled since the spread is located symmetrically across

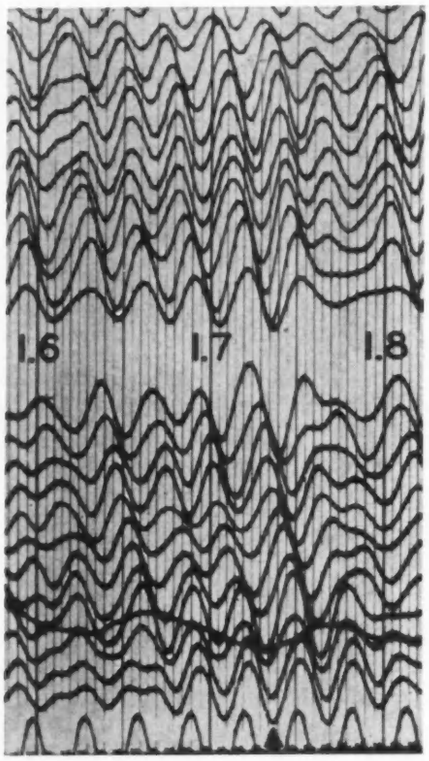


FIGURE 5—A small section of a seismograph record showing reflections with considerable dip.

the shot point. Delta T, or rate of dip, would have to be defined in another way if the shot was placed at the end of the cable rather than in the center.

Delta T would be the time difference across the spread reduced by the "reflection time difference" introduced by the dimensions of the spread. We could measure the rate of dip in a variety of ways. Usually, it is given as milliseconds per spread length. It could also be given in milliseconds per mile, or if you have a map contoured in feet, you could determine the rate of dip in feet per unit of map distance, whether it be feet per mile, feet per shot point spacing, etc. Rate of dip in milliseconds across a split spread is one of the things that is commonly used in our calculations for dip migration. The other thing that we must use is the two-way reflection time. The reflection time, of course, must be adjusted for weathering and surface elevation.

Migration is needed to improve the accuracy of calculations in order that drilling depths can be better predicted. As a general rule, the unmigrated profile will show highs that are too wide and it will show lows that are too narrow. This can be corrected by the migrating process.

In an extreme case, what appears to be an anticline on a time plot can be migrated properly to become a syncline. See Figure 6 for a display of this condition. The numbers along the reflecting horizon are reflection points which correspond with the numbered observation points along the surface of the ground.

Types of Devices. The various migrating devices could be divided into several classes as illustrated in the accompanying figures. One group we could call the heads. They pivot about a calibrated head which is scribed in any suitable measure of "rate of dip." Of course, there is an arm carrying a depth scale on which we mark off the distance from datum to the reflecting horizon. A small triangle is held against the edge of this depth arm at the proper position. A line of proper length drawn along the upper edge of

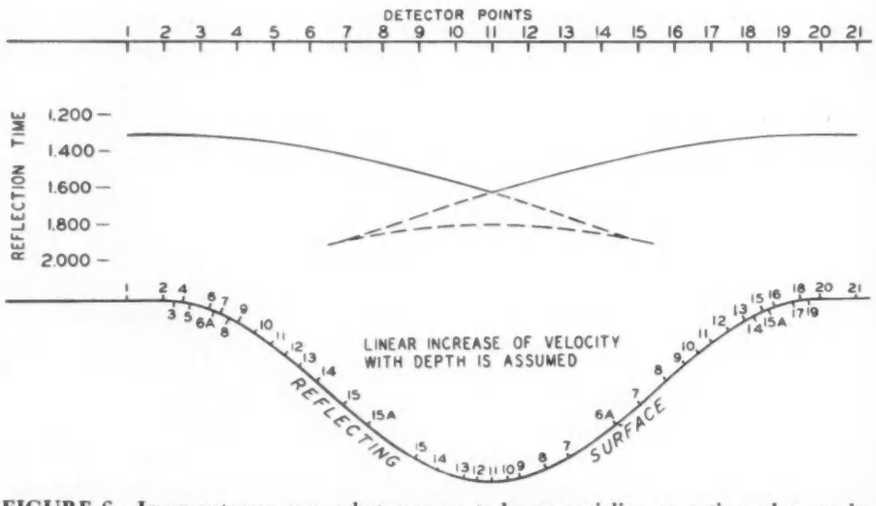


FIGURE 6—In an extreme case, what appears to be an anticline on a time plot can be migrated properly to become a syncline. This figure is an interesting display of this condition.

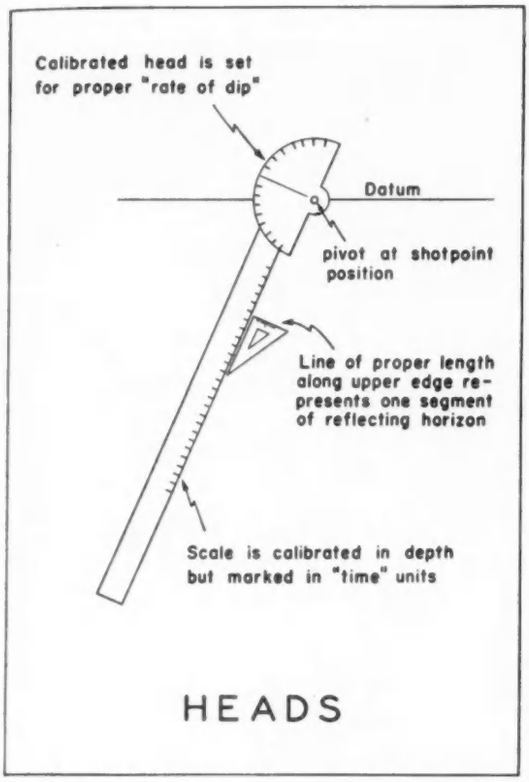

Calibrated head is set for proper "rate of dip"
Datum
pivot at shotpoint position
Line of proper length along upper edge represents one segment of reflecting horizon
Scale is calibrated in depth but marked in "time" units
HEADS

FIGURE 7a—The head is a migrating device which pivots about a calibrated head which is inscribed with a suitable measure of the rate of dip.

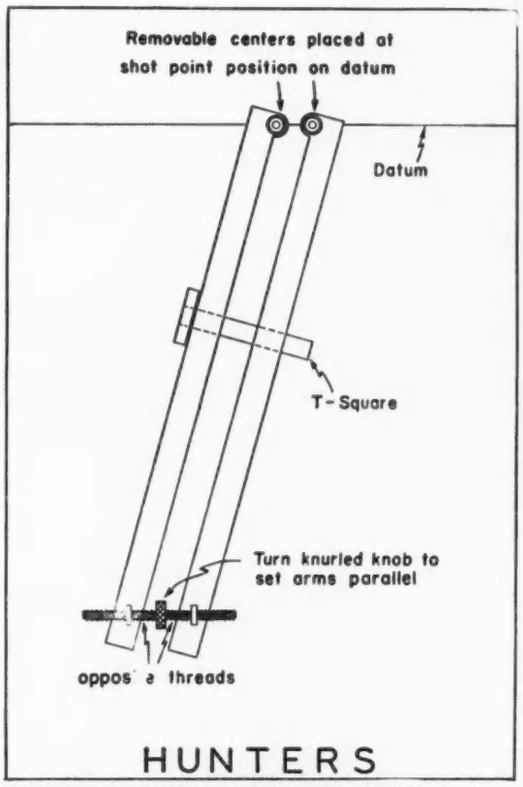
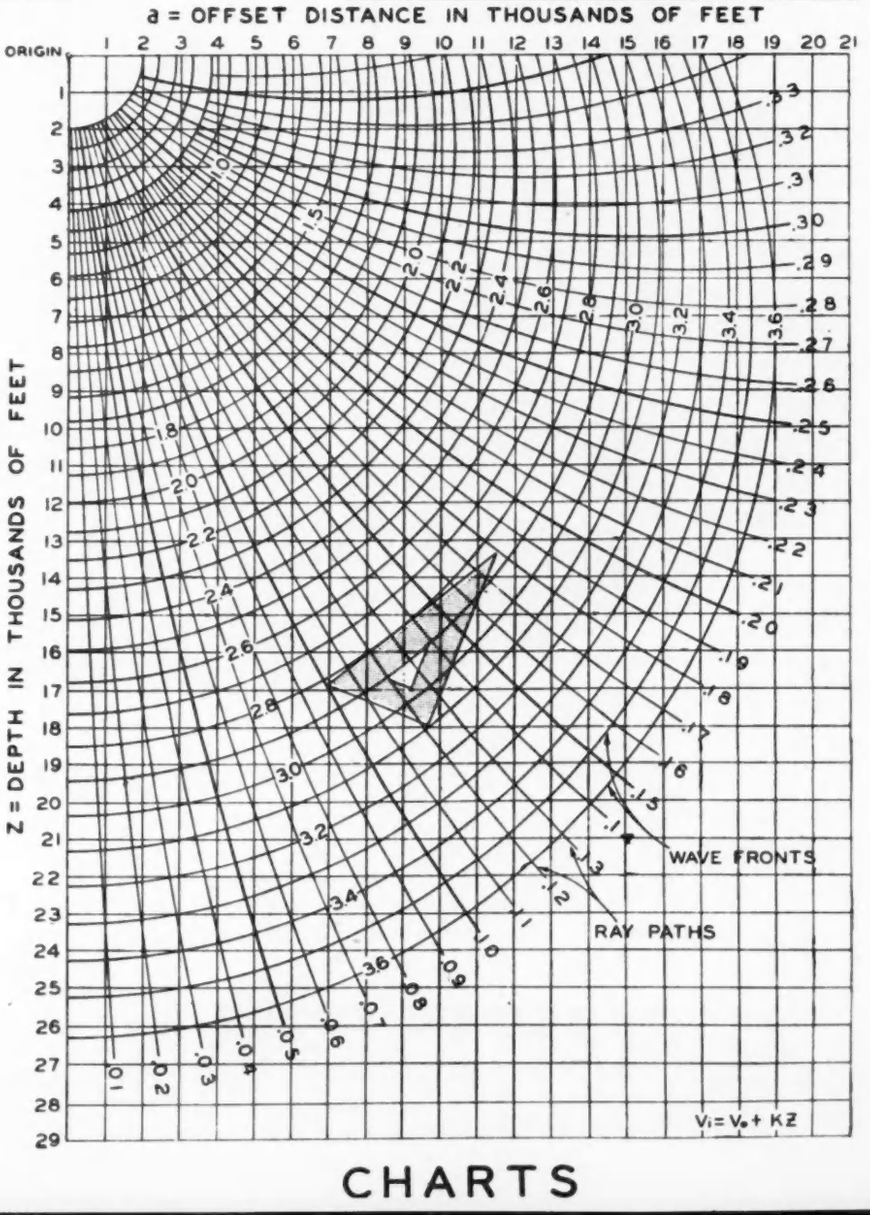


FIGURE 7b—The hunter is a two-arm device that hunts for a solution on the basis of two reflection time values and does not require an evaluation of the rate of dip.

FIGURE 7c—The charts use two families of curves in chart form with the proper rate of dip and the right two-way time are used to find a point on the wave front. A tangent drawn through this point represents the reflecting horizon at its proper attitude.



the triangle represents one segment of the reflecting horizon.

An interesting one arm device results when we assume a constant velocity of 10,000 feet per second. No head is required. Dip is "set" at a time of two seconds on the depth scale. At that "time" the device is moved 100 feet in the proper direction for each millisecond of dip across 1000 feet of surface coverage.

A second group we could call hunters. The two arm devices fall in this class since they merely hunt for a solution on the basis of two reflection time values, and do not require an evaluation of rate of dip.

A third technique we could call charts. Using the two families of curves on the chart, we locate the proper rate of dip and the proper two-way time. A line drawn tangent to the wave front at this point represents the reflecting horizon at its proper attitude.

Other tools for migration include analog devices, computing machines, etc.

ACKNOWLEDGMENT

The writer wishes to thank Gulf Oil Corporation, the Oklahoma Geological Society and the *Shale Shaker* for permission to publish this article in WORLD OIL.

Peck Reaves examines a Drilco Rubber Stabilizer being used on Frontier Rig #4 while drilling with air near Carlsbad, N. M.

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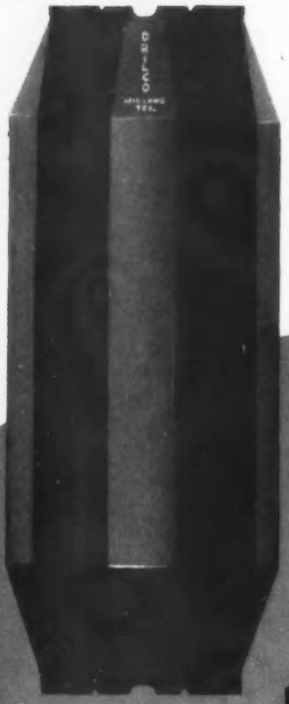

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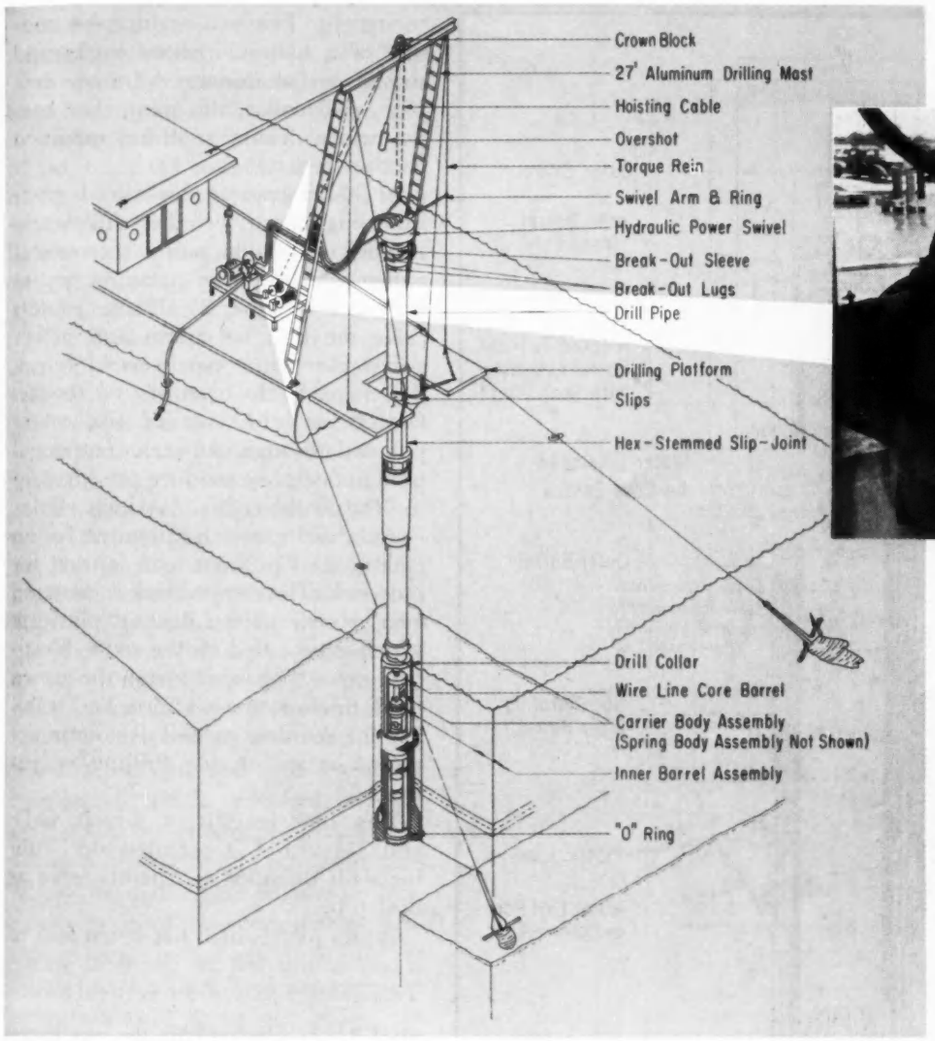


FIGURES 1 and 2—The basic equipment on the stern, requires about 30 feet of space and consists of hydraulic drawworks and swivel, an aluminum A-frame, drill pipe, drill collar, slip joint, core barrel, and a drilling platform mounted on the stern. At right is 30-hp aircooled gasoline engine which drives the drawworks through hydraulic pump motors capable of developing pressures up to 2000 psi.

20-Second Summary

Hydraulic rotary equipment mounted on steel hulled exploration boats is being used successfully to drill shallow core holes in the Gulf of Mexico in water 50 feet deep. Basic equipment consists of a hydraulic drawworks and swivel, and aluminum A-frame, drill pipe, drill collar, slip joint, core barrel, and a drilling platform mounted on the stern. Problems of anchoring, coring, circulation, etc., have been largely solved with the development of new techniques which are providing an inexpensive means of obtaining cores.

Rotary Coring From Small Boats

Small vessels, up to 100 feet in length, which can move from one location to another without a tow boat, provide good platforms for hydraulic rotary coring rigs.

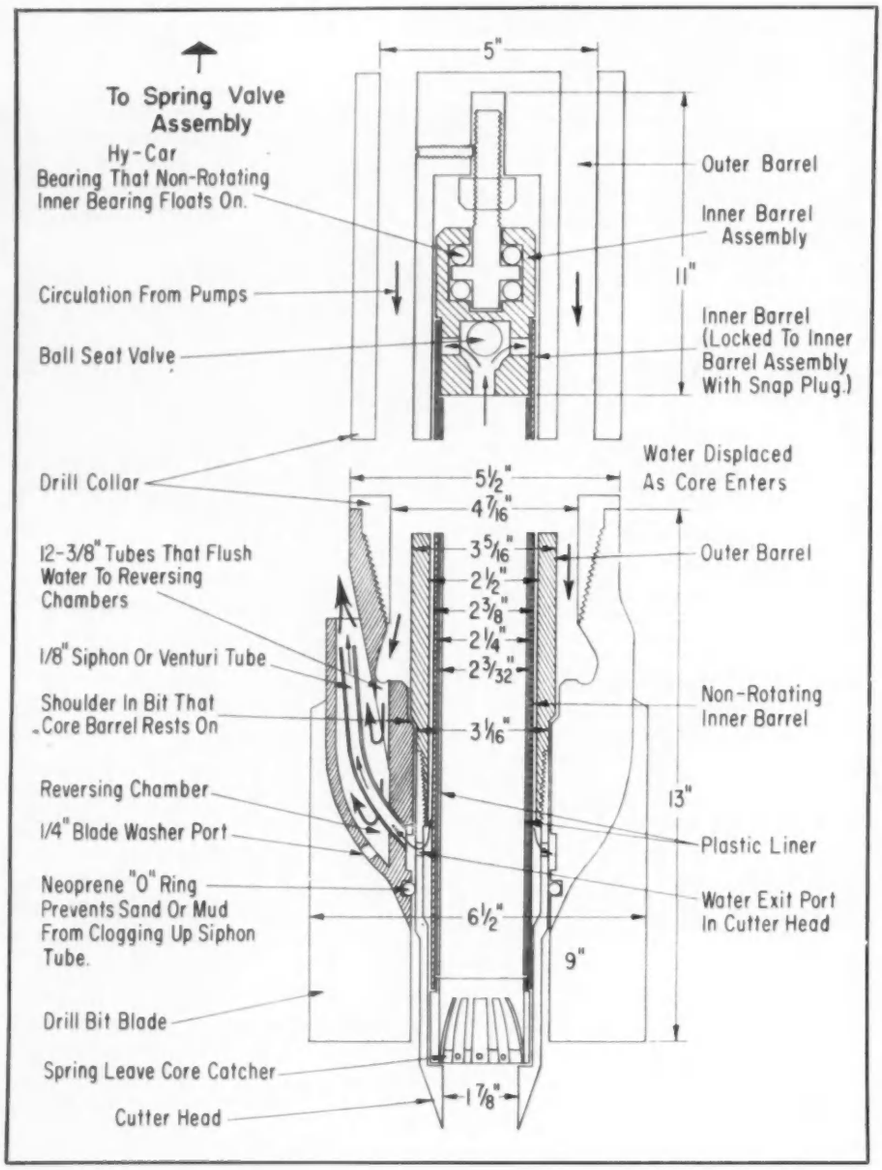
By R. A. Mills
Resident Manager Petroleos Hondurenos, S. A. Tegucigalpa, Honduras, C. A.

MAGNOLIA PETROLEUM COMPANY has used hydraulic rotary equipment mounted on small exploration boats to drill shallow core holes in the Gulf of Mexico. Ten foot cores have been recovered 80 feet below the sea floor in water 50 feet deep.

Wireline equipment was used to eliminate round trips of the drill string and to prevent unconsolidated sediments from caving into the hole. Wave motion is compensated for by a slip joint inserted in the drill string and by a system which separates the hydraulic power swivel from the oscillating boat during coring operations.

Results prove the feasibility of shallow coring from small boats anchored at sea.

Description of Equipment. Boats with 30 or more feet of space on the stern are suitable for mounting the



coring rig. The basic equipment consists of a hydraulic draw works and swivel, an aluminum A-frame, drill pipe, drill collar, slip joint, core barrel, and a drilling platform mounted on the stern (Figure 1).

A 30-horsepower, air-cooled gasoline engine drives the drawworks through hydraulic pump motors capable of developing pressures up to 2000 psi (Figure 2). These motors drive the hoisting drums and power swivel. Each motor delivers 11 horsepower to 30 foot-pounds of torque. Circulation consists of sea water pumped through a 2-inch centrifugal pump which can produce pressures up to 100 psi through a 1¼-inch choke.

An aluminum A-frame rated for an 8000 pound pull-out load is used for a derrick. The crown block is centered over a well in the drilling platform which is mounted on the stern. Vertical torque reins extend from the crown block down to the platform and stabilize the A-frame as well as counteract torque action during drilling operations.

Ten foot lengths of 4-inch O.D. and 3¾-inch I.D. seamless steel tubing with threaded tool joints serve as drill pipe.

A slip joint which has seven feet of travel is inserted in the drill string. This absorbs part of the vertical move-

FIGURE 3—Fluids within the core barrel are released through a ball seat valve at the top of the barrel as the core enters. They pass downward and between the non-rotating inner barrel and the outer barrel and leave the core barrel through ports near the lower end.

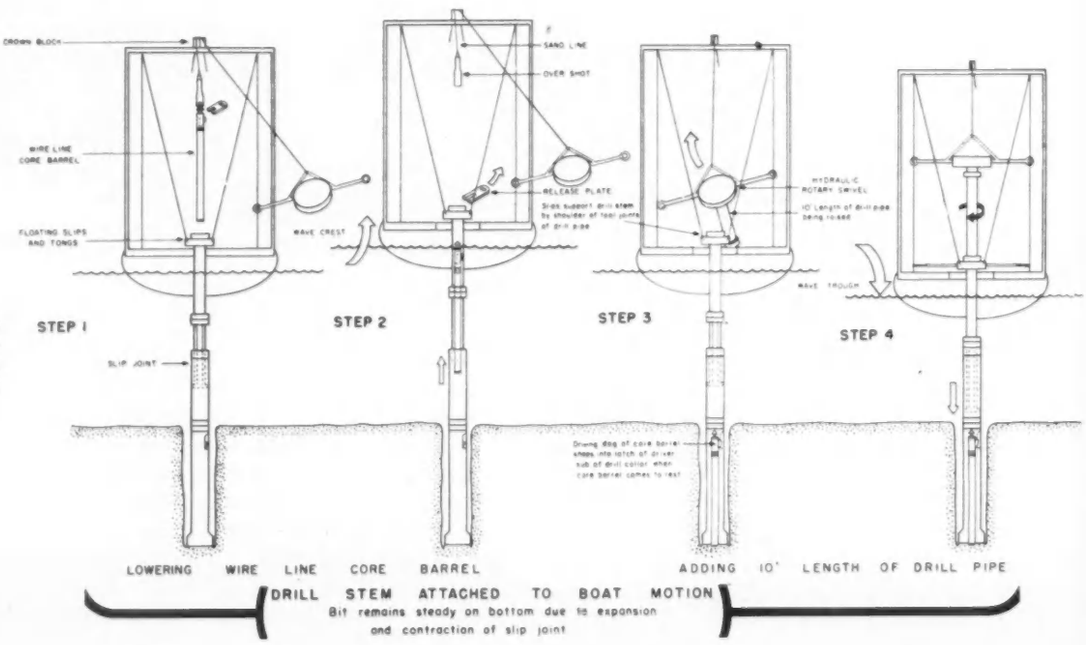

STEP 1
STEP 2
STEP 3
STEP 4
LOWERING WIRE LINE CORE BARREL
ADDING 10' LENGTH OF DRILL PIPE
DRILL STEM ATTACHED TO BOAT MOTION
Bit remains steady on bottom due to expansion and contraction of slip joint

FIGURE 4—Coring operations and the function of the various pieces of equipment are shown while drilling a core.

ment of the boat, helping to keep the bit on the bottom. The slip joint consists of (1) an exterior collar which is attached to the drill pipe below, (2) a hexagonal-shaped mandrel which slides inside the collar and is attached to the drill pipe above, and (3) a wash pipe which is attached to the lower end of the mandrel and slides inside the collar as well as down into the drill pipe below.

The drill collar is 16 feet long and during coring operations houses the wire line core barrel. It is fitted with a bit which has three blades and three U-shaped ports between the blades. While drilling, a considerable amount of the circulated fluids leave the drill string through the nose of the bit, aiding the cutting action. While coring, however, circulated fluids are forced out the U-shaped ports by the core barrel. They are thus directed upward on the outside of the drill string and reduce friction between the drill string and the surrounding sediments.

Cores are obtained with a wireline core barrel which is locked into the drill collar by means of a latch that allows a driving dog to rotate the barrel as the drill collar is rotated. The cutter head of the core barrel protrudes three inches ahead of the bit on the drill collar. This arrangement permits a core to be cut before the

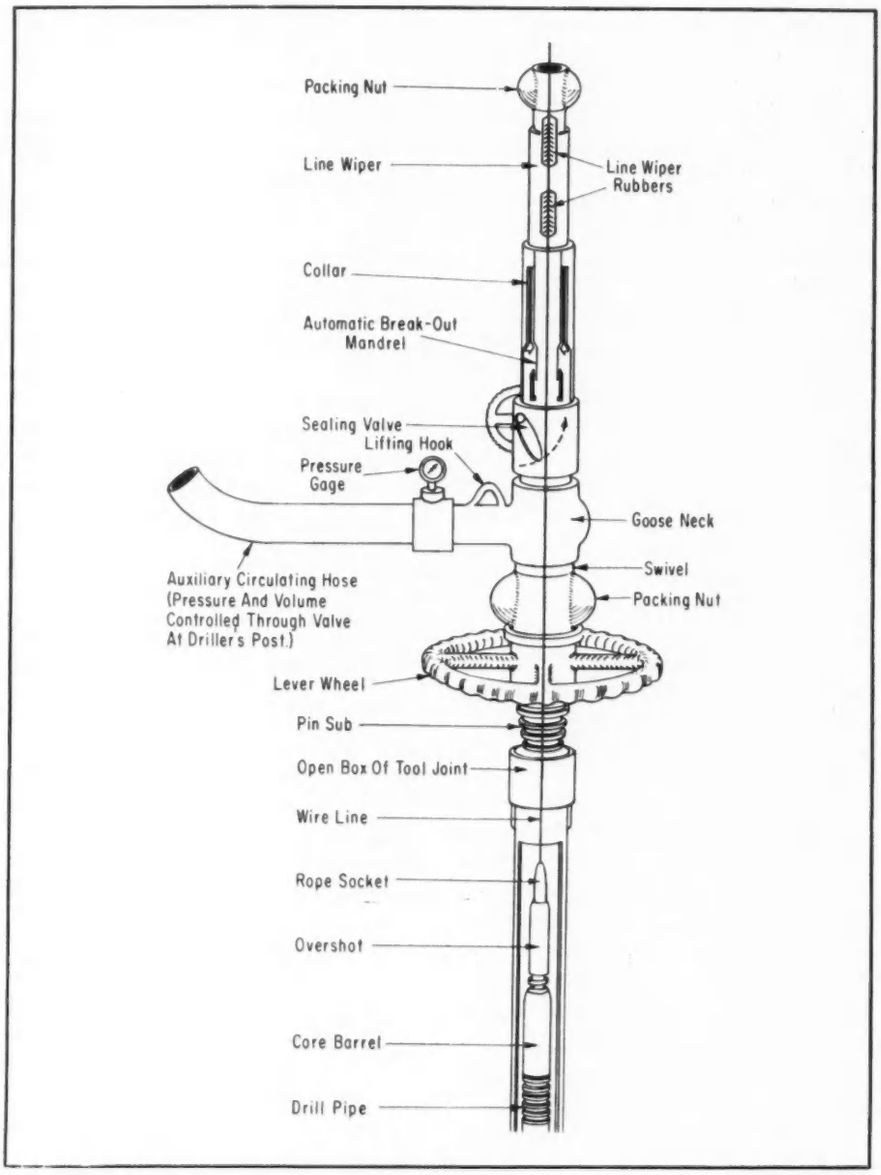
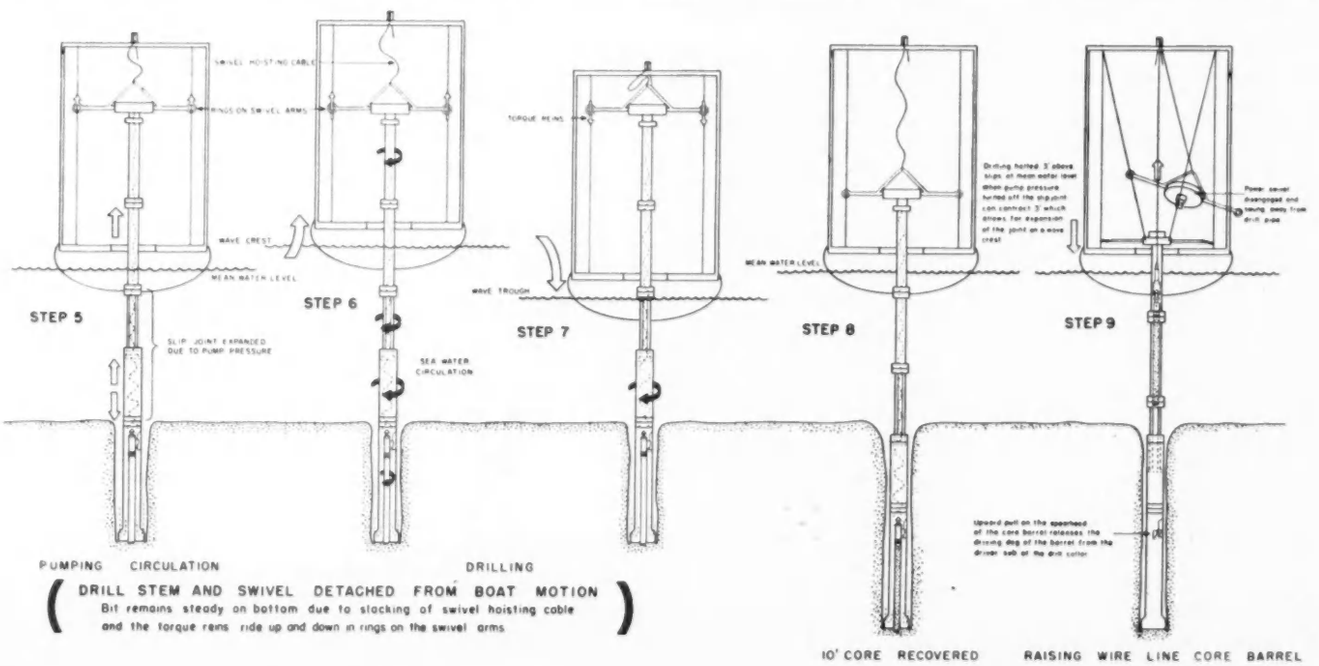


FIGURE 5—When a closed mud circulation system is not used this auxiliary circulating head can be attached to the circulating pump with an auxiliary hose and screwed to the drill string as soon as the power swivel is removed.


STEP 5
STEP 6
STEP 7
STEP 8
STEP 9
WAVE CREST
MEAN WATER LEVEL
WAVE TROUGH
SEA WATER CIRCULATION
PUMPING CIRCULATION
DRILLING
10' CORE RECOVERED
RAISING WIRE LINE CORE BARREL
DRILL STEM AND SWIVEL DETACHED FROM BOAT MOTION
Bit remains steady on bottom due to slacking of swivel hoisting cable and the torque rens ride up and down in rings on the swivel arms

drill bit deforms the soft formations. The core barrel is fitted with a non-rotating inner barrel which contains plastic tubing. After a core has been obtained, the plastic tubing is easily extracted from the barrel and provides a convenient storage for the core. Cores 10 feet long and 2 inches in diameter can be obtained.

Fluids within the barrel are released through a ball seat valve at the top of the barrel as the core enters. They pass downward between the non-rotating inner barrel and the outer barrel and leave the core barrel through ports near the lower end. The fluids then pass through venturi tubes mounted in the U-shaped ports in the drill bit (Figure 3).

A pipe rack upon which a traveling dolly is mounted aids in handling the drill pipe and core barrels.

Anchoring. Small boats must be anchored into the wind and current to reduce boat roll. Four 100-pound anchors can be set equidistant from the boat and at 90-degree angles from each other by an adept operator on a maneuverable boat. It is suggested that four mooring legs, each consisting of an anchor, anchor chain, line, and mooring buoy be dropped at four points in the form of a square. An auxiliary power launch can then be used to attach manila mooring lines to the buoys. The anchor chain and mooring buoy will "damp" the mooring lines and prevent sudden stresses due to wind or current shifts from dragging the anchors.

Coring Operations. Coring operations and the function of the various pieces of equipment are shown in Figure 4.

After the drill string has been made up and lowered to the sea floor, the wire line core barrel is positioned in the drill collar by dropping it down the drill string (Figure 4, Steps 1 to 4). During this operation, the slip joint expands and contracts with the rise and fall of the boat. After the slips are removed and circulation is started, the slip joint assumes a position which is determined by the weight of the drill string as compared to the circulating pressure. The weight of the drill string tends to contract the slip joint whereas the pressure due to circulation tends to expand it. After the core has been cut, the core barrel is withdrawn from the drill string and the core removed.

Wave action is partially overcome by slacking the hoisting cable of the hydraulic power swivel, allowing the swivel to ride on top of the drill string. Torque reins balance the swivel through rings mounted on the ends of swivel arms when the boat pitches up and down. This system, while satisfactory for shallow coring in soft clay and sandy mud, is unsatisfactory when coring in unconsolidated sands or shell debris. These dilatant sediments either pack and plug the mouth of the core barrel as weight is applied to the bit or flow out as the core barrel is withdrawn from the drill string.

Soft silts and clays are cored with low circulation pressure and slow rotary speed. A smooth tapered cutter head with small ¼-inch teeth is best suited for coring these sediments.

Stiff clays require a cutter head with large external teeth. If the clay is encountered with only a short length of drill string in the hole, pull down weights hung from the swivel arms may be necessary. Usually, maximum pump pressure and rotational speed are needed for this hard material. A spring loaded slip joint mounted in the upper part of the core barrel permits the cutter head to retract flush with the drill collar bit. This bit can then help cut the core and the stiff clay is prevented from "balling" up on the core barrel cutter head.

Unconsolidated sands and shell debris are difficult to recover without delicate weight control. Weight on the cutter head should be kept to a minimum and circulation pressure held at a low level to prevent sand from being washed away. A smooth tapered cutter head with small teeth gives best results. The cutter head should have a considerably smaller I.D. than the plastic tubing in the inner core barrel. The sand or shells must be cut and trimmed into small laminae which will ride up the plastic tubing. Any variation in weight will interrupt this process and cause the dilatant material to plug the tube. A core catcher with soft leaves is necessary to seal completely the cutter head after the core has filled the barrel. A cloth "shirt tail" mounted behind the leaves of the catcher will often aid in plugging the cutter head so that loose sands will not fall out as the barrel is withdrawn.

Circulation. Loose sand presents a problem in rotary coring operations because it sloughs easily and freezes the drill string. During rotation of the drill string, circulation helps prevent the pipe from sticking in collapsing sediment. However, when rotation and circulation are discontinued in order to add pipe or to withdraw the core barrel, the sand quickly settles and binds the drill string. In addition, the sand will often flow back into the drill collar due to hydrostatic pressure after the core barrel has been removed. This material contaminates the next core and restricts core recovery.

In the absence of a closed mud circulation system which requires expensive sub-sea wellhead equipment, an auxiliary circulating head is suggested. This head (Figure 5) attached to the circulating pump with an auxiliary hose, could be rapidly screwed to the drill string as soon as the power swivel is removed. Circulation could then be resumed immediately. Wireline equipment could be run through the head by means of valves and an automatic break-out mandrel. This equipment would provide near continuous circulation and allow deeper penetration into sandy formations.

Conclusions. Steel hulled exploration boats between 75 and 100 feet in length provide good platforms for small hydraulic rotary rigs. The type of rig described here is capable of recovering cores in the Recent and Pleistocene sediments down to depths of 100 feet below the sea floor. Recovery in deeper depths could be accomplished by using the same techniques with larger equipment.

Cores in the upper 300 feet of section in offshore areas provide excellent information for Recent sediments research studies, foundation engineering, and near surface exploration programs. Small core vessels which move rapidly from one location to another independent of tow boats provide an inexpensive means of obtaining cores.

REFERENCES

[1] Stormont, D. H., 1956, "How Richfield is Core Drilling from a Floating Barge," *Oil and Gas Journal*, February 27, pp. 130-134.

EDITOR'S NOTE: Author Mills formerly was with Magnolia Petroleum Company, Field Research Laboratory, Dallas.

An outline to more profit . . .

I. Requirements for a good safety program on a drilling rig

A. Support of Top Management

1. Well planned program
2. Good management to direct program
3. Field management personnel sold on value of program
4. Continual motivation of field operating personnel to keep program going

II. Specific Items Needed in a Rig Safety Program

A. Pre-employment physical examination

B. Definition of safe operating practices

1. Training program for new employes
2. Education program for employes

C. Regular inspection of equipment for physical hazards and unsafe operating practices

1. Daily inspection by crews
2. Weekly or monthly inspection by field superintendent
3. Monthly or bi-monthly inspections by company safety director or insurance company safety engineer
4. Written suggestions for correction of physical hazards and unsafe work practices
5. Follow-up by field supervisory personnel to see that corrections have been made

D. Safety Meetings

1. Weekly meetings conducted by driller or toolpusher
2. Monthly or bi-monthly meetings conducted by safety director or insurance company safety engineer

E. Accident Investigation

1. Drillers and toolpushers report on cause of accident and what steps have been taken to prevent a similar accident
   a. Review of report by field drilling superintendents and safety director
   b. Follow-up by superintendents to see that proper corrective action has been taken

F. Incentive Program

1. Recognition of management
   a. Letter of commendation
   b. Certificate of achievement
2. Incentive Awards
   a. Gloves
   b. Billfolds
   c. Cigarette lighters
   d. Pen and pencil sets
   e. Watches
   f. Vacations

III. Specific Items That Constitute Unsafe Conditions and Unsafe Working Practices

A. Unsafe equipment

1. Worn drilling line, brake, tongs, snub lines, cathead catline, slips, handtools, chains and cables
2. Unguarded chains, belts, relief valves, and catheads
3. Poor ladders, catwalks, stairs, floors, derrick and pipe racks
4. Inadequate blow-out equipment
5. Unsafe heating equipment (stoves, etc.)
6. Poor rig housekeeping

B. Unsafe Practices

1. Drilling beyond limits of rig
2. Inadequate precautions against fire during drill stem tests
3. Inadequate knowledge and practice in use of blowout preventors
4. Breaking out with one set of tongs
5. Riding elevators with string of pipe
6. Heating butane tanks
7. Not using safety devices provided
8. Not using personnel protective equipment provided

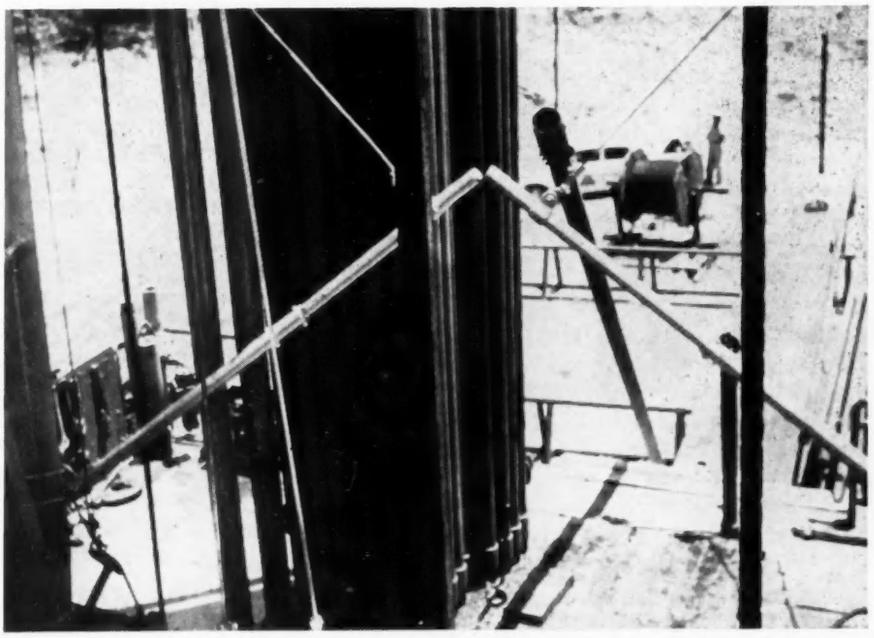
IV. Special Safety Devices

A. Rig Equipment

1. Crown safety cut out
2. V-door pipe guards
3. Drill stem safety plugs
4. Safety hook for riding elevators
5. Blowout preventors
6. Power slips
7. Power tongs
8. Cathead separator guards
9. Derrick exit line and trolley
10. Safety stoves
11. Safety cans for gasoline
12. Fire extinguishers
13. Color code

B. Personnel Protective Equipment

1. Gloves, hard hats, safety shoes, glasses and goggles
2. Respirators and gas masks
3. Safety lines and belts
4. Protective skin creams
5. First aid supplies



V-door pipe guards are one of the more recent devices. Guards hinge at base of each arm and allow unobstructed passage of drill pipe or casing into mast or derrick. Arms fold back to derrick or mast legs when not in use.

Testing Time Saver...

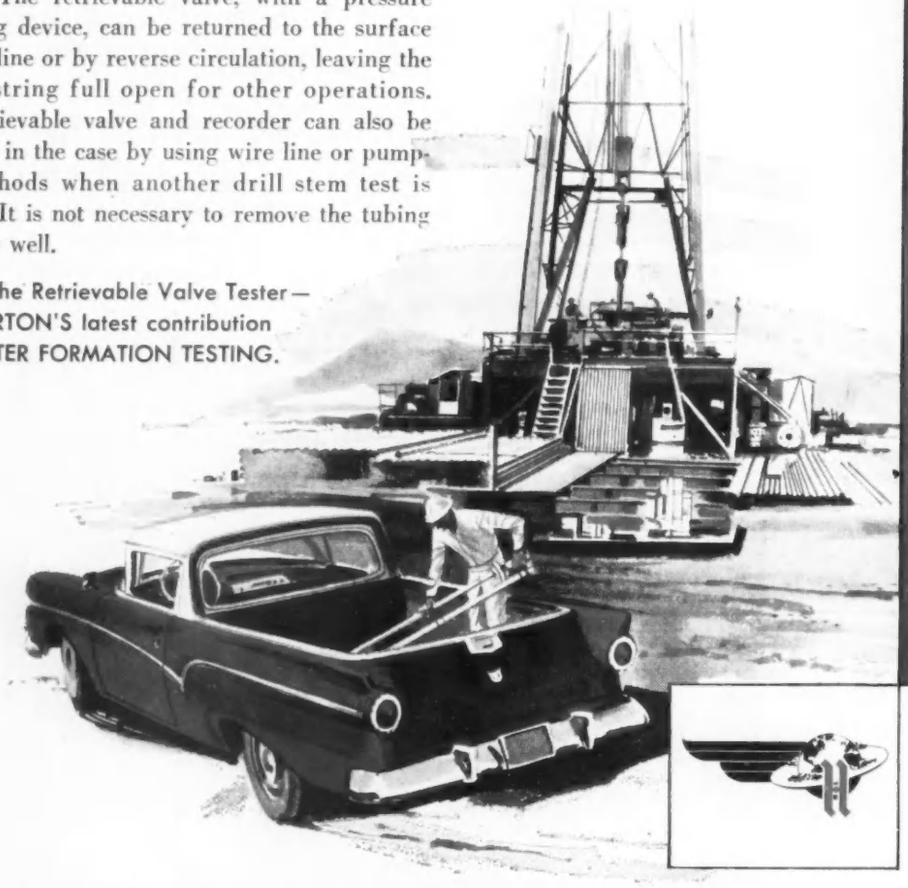
HALLIBURTON'S ONE TRIP RETRIEVABLE VALVE TESTER

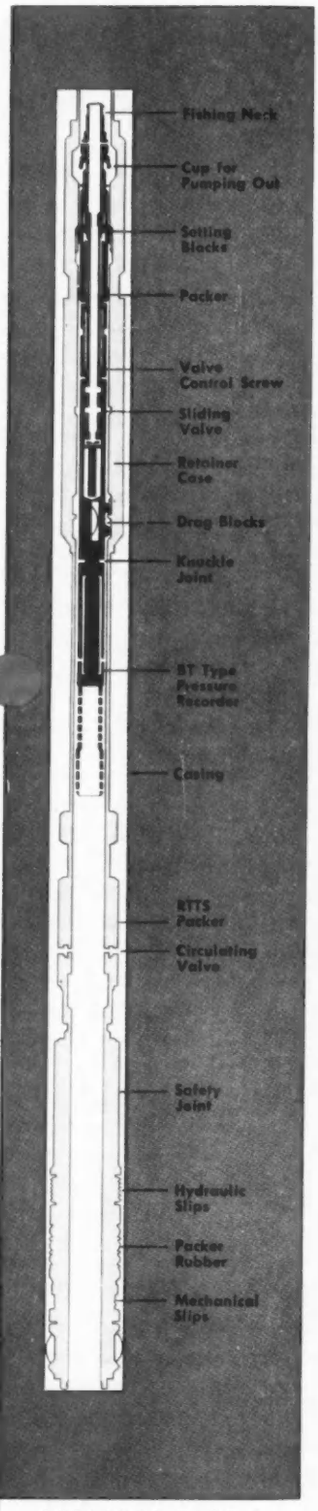
Reduced rig time during well evaluation and completion operations results when you include Halliburton's Retrievable Valve Tester in your string. Used above the RTTS Packer, the Retrievable Valve Tester permits several operations such as drill stem testing, cement squeezing, treating, perforating and simultaneous gamma-collar logging without the usual time-consuming round trips with tubing between operations.

30 SECOND TECHNICAL DESCRIPTION

This versatile testing tool consists of two assemblies—the retainer case and the retrievable valve. The case is run in the tubing string with the packer. The retrievable valve, with a pressure recording device, can be returned to the surface by wire line or by reverse circulation, leaving the tubing string full open for other operations. The retrievable valve and recorder can also be replaced in the case by using wire line or pumping methods when another drill stem test is desired. It is not necessary to remove the tubing from the well.

Specify the Retrievable Valve Tester—HALLIBURTON'S latest contribution FOR BETTER FORMATION TESTING.





RETAINER CASE & RETRIEVABLE VALVE TESTER

HALLIBURTON OIL WELL CEMENTING COMPANY DUNCAN, OKLAHOMA

TESTING SERVICES

HALLIBURTON—SETS THE PACE IN DRILL STEM TESTING

Additional profits brought about by safe operations mean more holes drilled, less damage to equipment, less labor turnover, lower insurance costs and better public relations. When the drilling contractor has a safe operation, there is a direct parallel to the advantages that are obtained by the operator for whom the contractor is drilling the well. The operator has lower costs by way of shorter time to complete the well, more productive time, more accurate results and lower insurance costs.

Why Accidents Are Costly. Rig accidents are costly for a number of reasons. The first is that an injured man who is receiving medical care represents additional cost to the contractor. The contractor also risks having to pay a high permanent disability payment to the injured man, regardless of insurance provisions. Other factors involving indirect cost to the employer include time lost by fellow employes to assist the injured man; time spent by supervisory personnel in investigating an accident and replacing the injured man. In many cases there is damaged equipment involved in the accident which must be replaced and which represents considerable lost rig time.

It has been established by the National Safety Council and other organizations that the hidden cost of accidents is four to five times that of the direct cost. In many cases in the drilling industry, especially in offshore operations, the hidden or indirect costs of accidents are much higher.

The Contractor Pays. Many contractors are inclined to think their insurance takes care of all their accident costs. Most of the direct costs of accidents are covered in the insurance cost, but none of the hidden costs show up here. A contractor's insurance cost varies directly with the accident experience.

There are two basic methods by which a contractor's insurance cost is determined. One is the guaranteed cost plan in which the basic manual rate is set by the state in which he is operating and the other is a retrospective rating plan in which his own accident experience determines his insurance costs. A contractor with five or more rigs, and who has a good accident experience, can gain by the retrospective rating plan. The two or three rig contractor who is under the state's manual rating plan, and who has a few years of bad accident experience, soon finds himself in a position where he cannot buy insurance. In order to keep operating, he has to go into the state fund for insurance.

Actual Cost Figures. In order to show in actual figures how insurance costs can vary among contractors, here a few specific examples. Assume a contractor is operating in Oklahoma where the manual rate is $10.39 each week for each employe making $100 or more per week. With three five-men crews and a toolpusher on each rig, there are 16 men on which the contractor pays the $10.39 rate, each week. This would give a total of $166.24 a week per rig. Assuming each rig worked 48 weeks in the year. This would be a total of $7,979.52 for insurance per year per rig at the manual rate of $10.39.

Take a contractor who has been on a retrospective rating plan for at least three years and has reduced his rate to $4.25 per $100 payroll on each man per week. With 16 men per rig, this would be $68 per week and the rig operating 48 weeks per year, the total would be $3,264 per rig. A saving of $4,725.52 per rig per year.

Assume a third contractor who has had a poor accident experience and has gone into the state fund or under his retrospective rating has a rate of $28 per $100 payroll per week. Figuring this contractor's operations under the same basis as the other two, he would be paying out $21,504 for compensation insurance each year on each rig. This is almost three times as much as the contractor on the manual rate, paid and almost seven times as much as the contractor with the good experience rate, paid for compensation insurance on each rig.

Hidden Costs Greater. With the keen competition in contract drilling today, and with contract footage going lower and lower, it is easy to see, from this comparison the difference in a contractor's insurance cost can mean the difference in operating or not operating. These examples of rates were not just taken out of the air. They are actual rates of some drilling contractors in the State of Oklahoma. We would hasten to point out that the contractor with the $28 rate will not be in business long unless some changes are made in his operations. These are only direct costs of the accidents. Taking the low figure of the hidden cost as four times the direct cost, the accidents of the contractor with the $4.25 rate are costing him $13,056.00 each year on each rig. For the contractor with the $28 rate, accidents are costing him $86,016 on each rig each year. With such a difference in operating costs, the contractor with the high rate can not possibly compete for contracts over a long period of time.

Less Human Suffering. The dollars and cents portion alone shows the importance of safety on a drilling rig, not to mention the pain and suffering of the injured individual who has an accident, and the suffering of his family in the event of a serious or fatal accident. It can be said that safety is more important on a drilling rig than any other phase of industry, but comparing the drilling industry with other industries in which there are many hazards, you will see that the drilling industry certainly has room for improvement. Using the Oklahoma state rates as a comparison, the oil refinery state compensation rate is $1.42, the machine shop is $2.72, and the carpentry rate is $6.59. Comparing all of these various classifications to the drilling rate of $10.39, a person wonders why drilling is so much higher than these other working classifications. They have a few of the same hazards that are encountered on a drilling rig.

Industry Problems. The concept of safety is different in the drilling industry than in general industry. The idea is that drilling is a rough and tough job and you have to expect accidents on each well that is drilled. You have field supervisors who came up through the ranks with little or no safety education. In addition you have widespread operations making it harder to carry out a safety program. There is a large turnover in personnel, little opportunity to screen employes, and short training time for new employes. With these problems, how can a drilling contractor go about reducing the accidents on his rigs? A good safety program is needed. An outline which gives some specific items that are needed to form and carry out a good safety program is given on Page 57. This outline includes items that constitute unsafe conditions, unsafe .working practices, and special safety devices which can help make the rig as safe as possible. —**The End**

Let's Re-Examine Casing Design Considerations

Instead of hedging on loading considerations for collapse, bursting, and tensile strength, modify the design factor to a level commensurate with the job to be accomplished.

By Robert J. Stoup, Metallurgical Engineer,
Spang-Chalfant Division,
The National Supply Company, Ambridge, Penn.

DESIGN OF OIL WELL casing strings is apparently based too commonly on examples in manufacturers' literature and suppliers' handbooks, it is indicated by the author's contacts with users of large quantities of tubular products. This information, excellent at it may be, and supplemented in some instances with ingenious graphical methods, does not require an understanding of fundamentals.

Since such aids cannot cover all possible contingencies, routine handbook users may quickly become involved with unfamiliar factors when faced with a design problem outside the manual. This is particularly noticeable when a shortage of pipe severely modifies engineering considerations.

It is possible that insufficient explanation is available to those responsible for casing string design, thus limiting their understanding of the basic reasons for design procedures. These basic factors in the design of casing are, therefore, being reviewed here.

Another reason for re-examining our methods now is a trend in the use of digital computers for selecting the most economical casing string, particularly by major oil companies. Although many contingencies can be explored quickly by a computer, it is no more accurate than the data and procedure that is run through it. Consequently a knowledge of the limitations of our design formalities is necessary for proper utilization of this tool.

Although the design of a casing string is involved because of many considerations, such important variables as clearances, landing procedure, and wear caused by drilling are omitted and only collapse, tension, and burst are treated. It is taken for granted the reader is generally familiar with the routine commonly used; that is:

- The string is studied with respect to resistance to internal pressure, and only those items that meet the requirements are considered.
- Starting at the bottom, the collapse load which incorporates a design factor is computed and a weight and grade meeting the requirements is selected.
- By trial and error, graphics or mathematics, a location is found further up the hole where a lesser weight or grade corrected for the hanging weight of the casing below it will meet the collapse conditions. Thus the length of the bottom section is determined.
- This procedure is repeated with subsequent sections until collapse is no longer of any importance and the upper part is then completed with sizes and connections of adequate tensile strength.

In constructing a casing string around the three prime considerations of external and internal pressure and tension load, the designer must, whether he recognizes it or not, be guided by the following as principles:

- He must accept the minimum performance properties of the available material as given by the American Petroleum Institute or in the case of non-API items, the information of the manufacturer.
- He must assume certain loading conditions will be present in the well not only at the time of running the casing, but during the productive life of the well.
- To allow for the unknowns, he must employ a design factor in his calculations commensurate with his best judgment.

These are not completely independent, but together they make up a framework of design. If the same procedure of basic information and assumptions is used every time, then experience soon teaches modifications that may be used to advantage. If one type of failure occurs consistently, the yardstick of that vulnerability is changed until the difficulty is eliminated. On the other hand, if no failures occur, then the possibility of reducing the protection against that particular exigency can be considered. To take full advantage of the potentialities, however, the basic theory must be well understood.

Minimum Performance Properties. The minimum collapse resistance, joint strength, and internal pressure yield for all API sizes and grades of casing and tubing is given in API Bulletin 5C2. These values depend to a large degree on the yield strength of the steel. Since the manufacturer of tubular goods must comply with the minimum yield strength as an acceptance standard, it is clear only a rare lot of steel will be down to the minimum. The maker must aim higher than the minimum and the average of all the tests will greatly

exceed the lower limit. In terms of performance properties, therefore, API values will, 95 times out of 100, be substantially exceeded. This should be gratifying to the purchaser but should not be relied on for design work since a single length at the minimum is still a possibility and could cause failure in otherwise high property material.

A natural question arises as to the validity of the listed minimum values of 5C2 and how well they may be relied upon. Formulas on which the figures are based are partially explained in the bulletin. As may be clarified by a study of API Drilling and Production Practice of 1939 and 1940, the collapse and tension values are taken from full size tests, the data being treated by accepted statistical methods. The goal was to establish minimums which would be exceeded in 99.73 percent of the tests, but this was later modified to permit theoretically a slightly greater percent of failures. The internal yield pressure is expressed by Barlow's formula with an allowance for the minimum wall thickness. Basing the internal pressure rating on yield strength is definitely on the conservative side as failure would be expected to be influenced more by the ultimate tensile strength. In the well a slight bulging caused by internal pressure if the yield strength were exceeded, would be expected to cause no producing difficulties. The possibility of thread leakage then probably accounts for the conservative figures.

The listed minimums have been essentially unchanged for 15 years, during which time some 20 million tons of casing must have been set with them as a guide. Apparently they have not contributed to any field difficulty of which the author is aware. Actually, there is a notion among user engineers that they should be revised upwards. This seems to stem largely from a vague feeling that the same grades of steel ought to be better now than when the original survey was made. There are reasons for counseling against such a change which will be discussed in a later paragraph.

As far as collapse is concerned, an important factor pertinent to design that is not covered in Bulletin 5-C-2 is the effect of tension on collapse. It is well known that longitudinal tensile stress reduces collapse resistance and this is important in a multiple section string. When changing from a heavier to a lighter weight the susceptibility to collapse should be checked at the *bottom* of the lighter section. It should be clear that although the tension load is higher at points above the changeover, the external hydrostatic pressure is lower. A decrease in collapse resistance resulting from increasing tension is much more than offset by decreasing external pressure.

As far as the magnitude of the effect is concerned, there is room for a difference of opinion as to which of several theoretical conditions might apply. Holmquist and Nadai (see API D&P Practice 1939) have advanced the following equation which fits observed data well:

$$r^2 - rt + t^2 = 1$$

where, in the case of combined tension and collapse,

r = fractional collapse strength
t = fractional longitudinal tension

For example, if a tube is exposed to a longitudinal tensile stress of 0.10 of its *average* yield strength, then r = 0.94 of original collapse strength (the negative root is taken as the solution because of the way the stresses are defined). Note the basis for computation is average yield strength, which has caused a logical difficulty in some minds. Corrections for collapse-tension and other combined stresses may be found in the literature as the "ellipse of plasticity" or tabulated in pipe manufacturers' handbooks.

Well Loading Hypotheses. In laying out a casing program, given minimum performance values, to complete the designing it is necessary to assume conditions of loading. Since every well is different, the customary practice is to use certain standard assumptions. Actually, these are arbitrary and in some cases completely erroneous; however, this does not matter if they furnish a solid base to which corrections may be applied.

Collapse Assumptions: An empty string of pipe closed at its lower end and surrounded by fluid is subjected to greatest collapsing pressure at the bottom which varies with the density of the fluid and depth of the well. Lacking accurate knowledge as to the weight of the fluid, it is common practice to postulate 9⅝ pounds per gallon mud (salt water), since its pressure gradient is ½ pound per foot of depth (an easy figure for arithmetical purposes). If the actual fluid weight is known, however, it should be used.

The primary assumption here taken for granted is that the casing will be empty at some time. This is not necessarily true but provides for the worst eventualities such as necessitated by swabbing or other completion practices and looks forward to the time when the inside fluid level might eventually reach the bottom of the well.

Other physical facts could be taken into account but are usually ignored; for instance, since longitudinal compression raises collapse resistance and the bottom lengths are generally in compression, allowance could be made for this beneficial loading. Or the buoyant effect of the mud on the weight of the lower sections could be considered as reducing the effect of tension on collapse of higher portions. Or since casing would never be empty before cementing, after the cement has set figure the lengths opposite the cement as being completely reinforced by the cement. All of these are partially or completely correct and could be used in calculations where they would add complexity to an already complex subject.

Tension Assumptions: In all computations involving tensile loads on the casing string, it is common practice to disregard the buoyant effect of the fluid in the hole and consider the weight of the casing as if it were suspended in air. This gives calculated loads higher than actual and tends to offset unknown frictional forces against the wall of the hole and shock loads caused by careless brake handling when reciprocating or landing. A small allowance might even be made for the effect of unbalanced internal pressure in reducing the severity of tensional stress induced by the hanging weight.

Internal Pressure Assumptions: We find more different opinions as to the basis for internal pressure calculations than for tension or collapse. To begin with, assume the bottom hole pressure can be based on ½ pound per square inch per foot of depth although this is too high in some areas and too low on the Gulf Coast where pressures approaching 1 pound per square inch per foot of depth

have been observed. Of course, if the bottom hole pressure or its outside limit is known, it should be used.

One school of thought recognizes any fluid outside the casing opposes the internal pressure with a counter pressure. This means only the top lengths need consideration since the rapid increase in external pressure with depth makes burst effects negligible lower down. A modification of this, according to one company, is that there may be thief sands which might drain off the upper fluid. That organization's engineering policy is not to use the beneficial effect of external pressure until an arbitrary depth of 500 feet is reached.

It is also well established in procedure that, because gases have weight, top hole pressure will be lower than bottom hole pressure by an amount depending on the gravity of the gas. This can be taken into account in proportioning the casing string.

It is recommended because of the critical nature of internal pressure as to safety; where pressure is expected to be substantial, it should be regarded most pessimistically as follows:

- Unless known, bottom hole pressure is to be mud weight times depth.
- The full amount of bottom hole pressure may be exerted anywhere in the string.
- Disregard all external pressure.

This may seem entirely unrealistic and unduly conservative, but actually in most cases, depending on the design factor, will not change present strings. (It is to be remembered a given tube section will collapse at a lower pressure than it will burst.) Adequate burst protection is of inestimable advantage when facing a problem of squeeze cementing or coping with a tubing leak.

(Every experienced field engineer knows of leases under-horsepowered with inadequate pumping units with lots of production left, but now faced with the issue of replacing at today's prices just because future requirements were not forecast when the program was first laid out. In the same manner with pipe, it is well to look to the future and avoid false economy which at some later date presents the operator with a well which can't be worked over or rejuvenated because of too little foresight in the casing program.)

Design Factors. In setting up any casing program proper allowance for unforeseen conditions deserves consideration. As applied here, it is called a "design factor" preferably, or to follow older usage, "safety factor." It would be imprudent of a manufacturer's representative to recommend a numerical value because that is a responsibility the buyer must assume, based on his knowledge of the practice to be followed in the use of the material. However, common trade custom seems to follow these values:

In Collapse	1.125
In Tension	1.60* or 1.80*
In Burst	1.00 based on yield

*It seems an unnecessary complication to do as some do and bring the yield strength of the pipe body into the picture with or without a design factor attached. In practice, we are not worried about the string stretching a little—we want to be sure only that it won't come apart. The minimum parting load of the API or manufacturer supplies this informaiton.

Future Progress in Design. Now that we have scrutinized some of the ideas behind casing design, let us examine some of the trends which have a bearing on present concepts.

These are large organizations who say in effect: "We are going to complete 50 wells this year in this area so let us take a calculated risk and modify our casing programs to the point where we can save 3 percent on each well. Then if we have only one failure this year due to the corner cutting, we can show a substantial cost reduction." Of course a smaller operator who is completing only one well or so a year cannot use this approach as it may be the first well that fails and he is not running enough strings to recoup this loss.

Even though a user may not want to accept this "calculated risk" approach, because casing is such a high percentage of completion cost, there is a constant pressure from top management on oil company engineers to reduce this outlay. But engineering-wise, as has already been discussed, for a given hole size there are only three ways to lower the casing string cost:

(a) Take an optimistic view of performance properties.

(b) Change well conditions or change method of assuming well conditions.

(c) Reduce design factors.

Some engineers take a short-sighted view that the situation would be improved if the API or the manufacturer would increase the performance properties of the casing. It is difficult to see what good this would accomplish as writing up the properties of the material would not make it any better. It would, however, from the user's point of view, serve one good purpose in that it would, in certain borderline cases, throw the responsibility of the failure back on the pipe maker.

Another way of reducing the investment in casing is by changing the loading assumptions. (Not the loading itself although this is subject to a limited degree of control as by using a lighter mud, for instance.) In collapse, we might assume as mentioned before, complete reinforcement of the casing by cement. Other dodges readily suggest themselves—taking compression in the bottom of the string into account in collapse, correcting for buoyancy in tension, or deducting the weight of the gas at the top in burst. Such refinements, while accounting for observed realities, appear to be approaching the problem from the wrong point of view, and in so doing, introducing unnecessary complications.

It seems the only logical approach for operators to save on a casing program is to keep the same minimums, assume standard loading conditions, and *lower their design factors.* In many instances, this approach has been successful. Some major oil companies have gone to a factor of 1.00 in collapse. Tensile factors have been modified particularly when the casing is run under adequate supervision. Only burst factors have not been significantly changed. The reason for this is that in high pressure areas the possible consequences of a failure (repressuring upper sands, loss of a whole producing formation, cratering, danger to life, etc.) are so extreme that no one cares to compromise with so critical an item.

Engineering-wise, it does not seem logical when trying to design as close as possible to reality, to "ride off in all directions" and change the fundamental standards and procedures in order to attain a goal when the better method is simply to modify the design factor (which is what design factors are for) to a level commensurate with the goal and then acquire field experience to prove or disprove the altered values. —**The End**

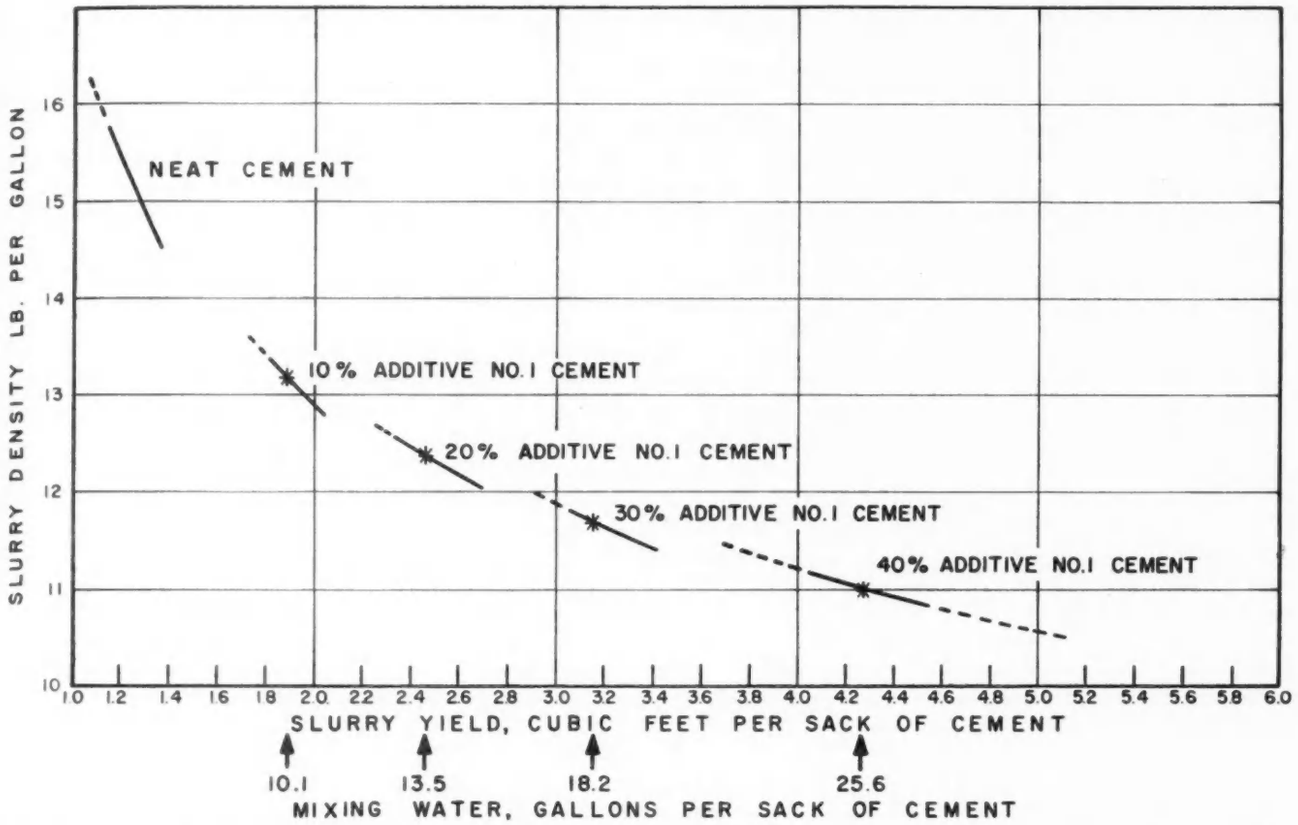


FIGURE 1—Density of the additive No. 1 cements plotted against water mixture and slurry yield. The asterisk shows the recommended density. Slurries represented by the dashed portion of the curves should not be used.

Special Additives Cut Cement Costs

Density reduction, water loss and setting time control, and an accelerator are all being used by Phillips Petroleum Company to reduce costs and provide more efficient cement jobs.

By E. W. Porter
Phillips Petroleum Company
Odessa, Texas

IT HAS BEEN apparent for a number of years that cementing materials have not entirely kept pace with other materials and techniques used in the drilling and producing industries. Mud weights on certain wells are being held to new minimums through the use of low solids and emulsion muds. At the other end of the scale, deep drilling is carrying wells into high temperature and high pressure zones where extreme mud weights are necessary. Increased emphasis is being placed on maintaining low fluid loss muds. Oil well cements, on the other hand, have had a minimum density of about 13 pounds per gallon, could not always be adequately and dependably retarded and have had extremely high water losses, which could not be controlled by any commercially available material.

The problems of the control of cement density, cement retardation and cement water loss was investigated by Phillips' Research and Development Department over a period of years and work is still in progress. Individual field tests have been run to check certain points. Three additives have been developed, which will be designated by numbers. No. 1 is a special diatomaceous earth used to reduce the density of cement slurries; No. 2 is a cellulose derivative used to control the water loss and thickening time of cement slurries; and No. 3 is a special type of sodium silicate which can be used to accelerate LWL-cement slurries when retardation is not needed. These additives allow the formulation of cement slurries with densities as low as 10.5 pounds per gallon, with water losses as low as 5 ml/30 minutes, and with a degree of retardation ample for any bottom-

hole temperature presently being encountered. These improvements will aid in solving the problems of lost circulation during cementing, formation damage due to invading filtrates, flash setting and inability to reciprocate or rotate casing during cementing. Although the severity of these problems varies from field to field, they exist to some degree in practically every well.

The technical data concerning these additives have been reported in the literature[1,2,3] and published in technical sales literature.[4]

No. 1 is generally added to cement in increments of 10 percent up to a maximum of 40 percent by weight of the dry cement. (Throughout this article, percent refers to parts by weight of the material per 100 parts by weight of dry cement.) The density decrease experienced by using blends of No. 1 and cement is achieved primarily by increases in the amount of mixing water used. No. 1 is a finely-divided powder which is dry blended with the cement at the blending plant. The mixture is readily slurried in the field and does not increase in density under pressure. Figure 1 is a plot of the density of the various No. 1 slurries against the gallons of mixing water per sack of common Portland cement. The yield in cubic feet of slurry is also shown. An asterisk is shown on each curve at the point of recommended density which is approximately halfway between maximum and minimum water in each case. It has been found that the slurries represented by the portion of these curves which is shown as a dashed line should not normally be used in the field. The slurry represented by the upper dashed section is generally too viscous to be picked up out of the mixing tub by the cementing pumps and the 24-hour strength of that represented by the lower dashed section may be below the desired strength. This latter slurry can be used any time its characteristics are recognized and allowance is made for those characteristics in designing the job.

These density, mixing water and slurry yield curves apply to all No. 1 systems made with common Portland cement whether additives Nos. 2 and 3 are present or not. The other additives are used in small amounts which do not materially affect the curves.

When higher early strengths are desired of additive No. 1 cements, they may be accelerated with calcium chloride. Four percent calcium chloride is used with the 40 percent additive No. 1 cement; 2 percent is used with all other systems. In certain areas, "high early" cement is available and the use of this material, with or without $CaCl_2$, will still further increase the early strength.

Tests have been made of additive No. 1 cements with varying quantities of salt up to saturation. Salt saturated cements are finding increased application for improved bonding to salt or salty formations. Normally, salt saturated cements are weaker than the same cement system without the salt. The addition of additive No. 1 counteracts some of this tendency toward decreased strength. The following table illustrates this fact:

Fresh Water Cement	Salt Saturated Cement % of fresh water strength of same system
Neat	41.5%
10% No. 1	52 %
20% No. 1	67 %
40% No. 1	125 %

Additive No. 2 is a cellulose derivative which is used to control both the water loss of cement slurries and the thickening time. The many benefits to be derived from the use of a low water loss mud are duplicated by a low water loss cement. In addition, low water loss cements, since they do not lose large quantities of water to the formation, do not decrease their thickening time downhole and, consequently, their placement is made more reliable. This additive is used with neat cement in concentrations of 0.3, 0.5 and 0.7 percent to make a 15 pounds per gallon slurry which will provide a two-hour thickening time in a well with a static bottom-hole temperature of 320°F. and greater thickening times at lower temperatures. If higher weights and longer thickening times are desired, a higher percentage of LWL cement may be used in combination with barite to provide systems capable of cementing any well. For shallower wells, LWL cements can be accelerated with additive No. 3, a special accelerator which does not damage the low water loss of the slurry.

Additives No. 1 and No. 2 may be combined to provide a combination cement with both low density and low water loss characteristics. The same general percentages of additive No. 1 apply to these systems as apply to straight No. 1 systems, but the percentage of additive No. 2 differs from that used in neat cement. One and one-half percent of additive No. 2 is used in a 40 percent No. 1 system and 1 percent of additive No. 2 in a 20 percent No. 1 system. These combination systems may be accelerated with additive No. 3 when such acceleration is necessary.

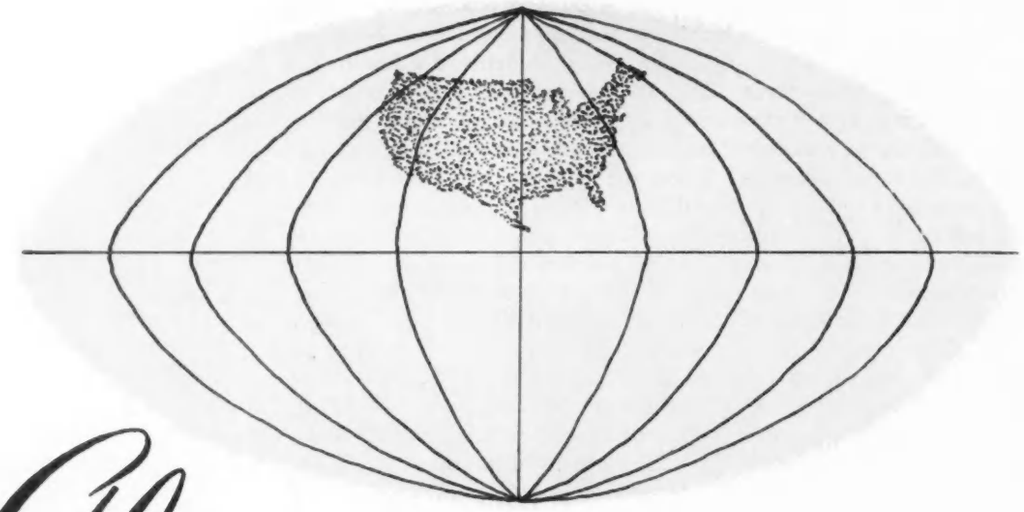
No attempt is made in this article to present detailed data on strengths, thickening time etc. as this type of information is available in handbook form.

A primary consideration of production men must always be, "How does it work in the field?" At the time the bulk of the laboratory data was presented, it was apparent that further lab testing was dependent on field verification of the information accumulated up to that time. To provide this verification, a series of controlled field tests were devised, individually, to answer specific questions to check points or systems under question. All of the possible combinations of these systems were run. A total of ten controlled tests were made, although rather careful checking continued on a large number of jobs after these ten. All of the potential problems which could be visualized were checked. The jobs were discussed with service company personnel, Phillips' Production personnel, drilling contractors and anyone else who might envision possible problems.

The points which were checked include dry blending, water loss, density control, field handling and mixing,

About the Author

E. W. Porter received a degree in general engineering from the University of Oklahoma in 1948. After graduation he was employed by Phillips Petroleum Co. in the Production department. He worked in several areas in Oklahoma and Texas prior to his assignment as a district staff engineer in Odessa, Texas, in 1949. In 1952 he was transferred to the Bartlesville staff of the company and in 1953 was appointed a special problems engineer. His work in that capacity included extensive field tests of the special additive cements referred to in this article. Porter is currently assistant superintendent of Phillips' West Texas district.



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separation either as dry material or in the mixing tub and a number of others. The experience gained in this regard can best be summarized by saying that the materials can be blended, handled and used with conventional equipment and techniques.

After the experimental jobs were completed, the materials were put into use in routine operations as a supply became available. The usual completion procedures were followed including fracturing, acidizing, perforating, zone completions etc; and no difficulty has been experienced which could reasonably be attributed to the type of cement used. A fairly complete analysis of the first 279 jobs using the special additives has been made. As a basis of comparison, 279 jobs of a similar nature, not using the additives, have been checked. The statistics used in this article pertain to these wells.

Additive No. 1 decreased the price of cementing materials $35,000 on these 279 wells. This is the direct cost of material at the blending plant as opposed to the material which would have been used. It does not include any allowance for increased fillup due to the use of a lower density cement. This increased fillup is estimated to average 10 percent, but an average is misleading in this case. On certain wells, the use of a lower density than previously available has resulted in several hundred percent increased fillup. In a number of cases, the desired fillup has been achieved in a single stage where previously two stages had been required. Low density alone is not a cure all, however, since 21 jobs using additive No. 1 were accompanied by partial or complete lost returns during cementing. These 21 jobs compare to 27 before the use of additive No. 1.

The field personnel using the special additives are establishing a particular blend or blends for a given field and using that blend as subsequent jobs are performed. It is believed that using more than one blend on a given casing string is good engineering practice, just as is the use of more than one weight and grade of casing. A single cement job frequently places different requirements on various sections of the cement. The cement covering a section to provide corrosion protection does not have the same strength requirement as the cement placed opposite a productive formation which is to be perforated and fractured.

Additive No. 2 has been used on 60 jobs. It was introduced to the field organization somewhat later than additive No. 1 since it represented a new concept in cement additives. Some of the theoretical benefits of a low water loss cement have been proved on these jobs, but the total accumulation of experience is not yet sufficient to prove the existence of all the benefits. Additive No. 2 is both a water loss control agent and a retarder. One important point which stands out is that the laboratory determined thickening time is dependable in field usage. Squeeze jobs on 15,000 foot wells in an area which has 305°F. static temperature at that depth are now being done by the hesitation method, using LWL cement. On the other hand, acceleration is possible and a number of LWL jobs have been done on which the cement was used on relatively shallow wells. There is an additional fillup due to retention of the water in the slurry. This additional fillup averages approximately 10 percent. There is some evidence of decreased formation damage, but additional work will be required to verify this point. Additive No. 2 has some suspending qualities, so it is an ideal material for the retardation of slurries which contain barite as a weighting agent.

One item which should be considered when measuring the water loss of these slurries is the sampling point. During the experimental work, it was discovered that the low water losses known to be possible were not developed by the time the slurry hit the mixing tub. A rather elaborate sampling device was built and a number of tests run and it was found that this was not important since the additional agitation gained in passing through the cementing pumps produced the desired low water loss.

Any of these materials may be adequately blended in conventional dry blending equipment. Ten minutes dry blending time is considered adequate. The materials other than the cement may also be transported to the job site and mixed into the required volume of water prior to the job. They can be added to the water through a hopper in much the same way gel is added to a mud, but at a faster rate if desired. The resultant slurry should be agitated or circulated continuously prior to its use. This slurry can then be mixed with the cement through conventional cement mixing equipment. The use of this method will allow all the dry materials to be brought to the well in sacks.

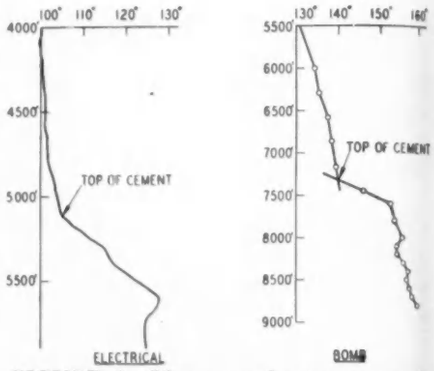


FIGURE 2—These are the two types of curves that are obtained when running a 12-hour temperature survey on 40 percent of additive No. 1 cement. These curves are not of the same well.

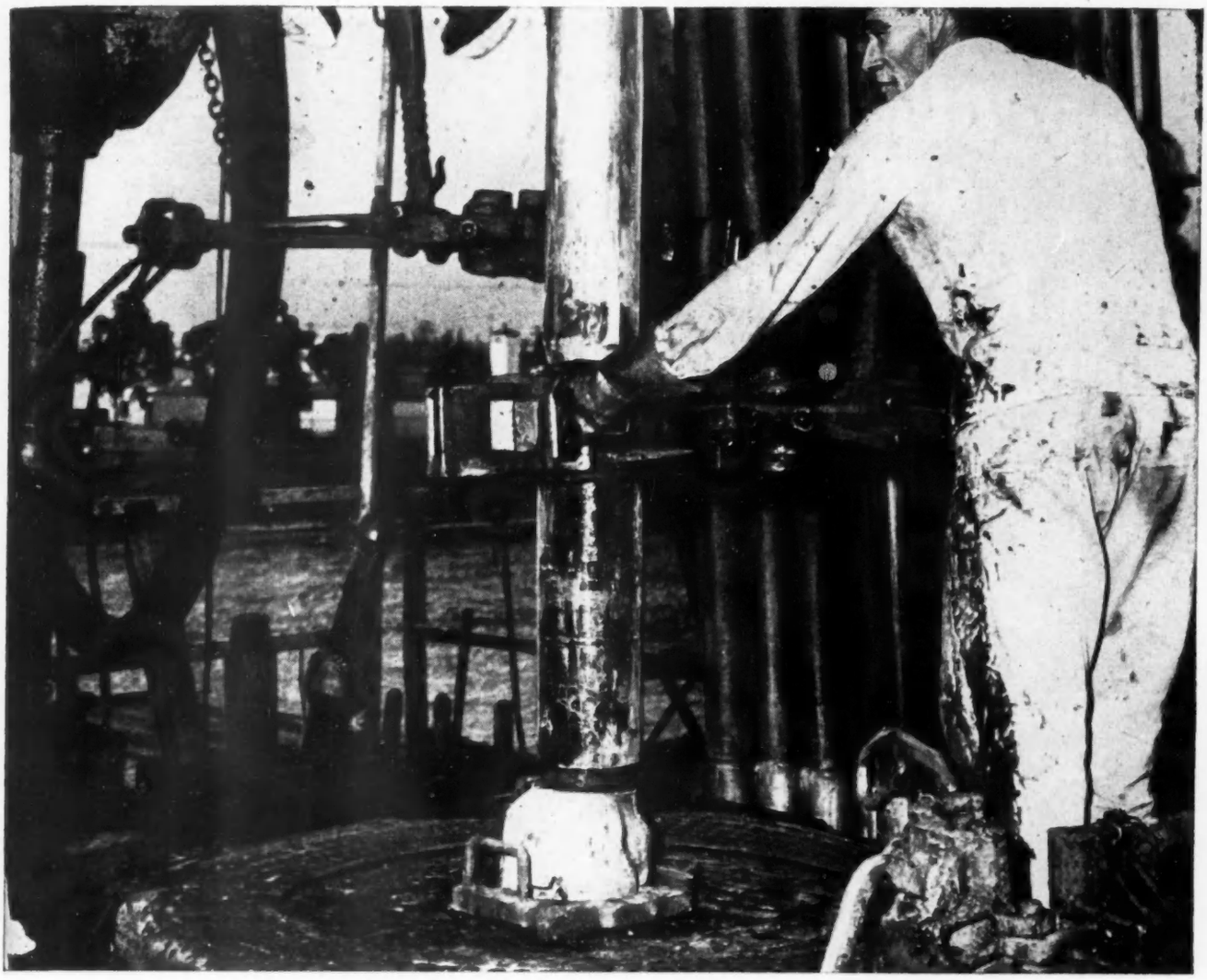
The viscosity of slurries using the special additives will be similar to that of gel cements. With these, as with all other cements, it is good practice to weigh the slurries during the job in order to maintain the proper density control. The slurries thin out after pumping. Slurries which contain additive No. 2 will be slightly more viscous initially than those which do not contain LWL and a slightly lower density is usually recommended for this reason.

The data published on these materials are based on American cements.

In evaluating the 24-hour strength, it has become Phillips' practice to use the electric log temperature rather than the static bottom-hole temperature. This temperature will be a little lower than the static temperature and consequently provides a built-in safety margin. It has been found that in many instances a well does not reach static temperature in the 24 hours after cementing. If only the static temperature is known, this may be derated by 15 percent in evaluating the early strength.

Cement containing additive No. 1 will give a smaller temperature kick than neat cement for two reasons. The thickening time has been somewhat extended and a great deal of the cement has been replaced with materials which do not contribute heat to the cement column. It is readily detectable, however, with either a bomb survey or an electrical survey in a time period of 8 to 18 hours after placement. Figure 2 shows two temperature surveys on 40 percent No. 1 systems.

One added concept is necessary when attempting to locate LWL ce-



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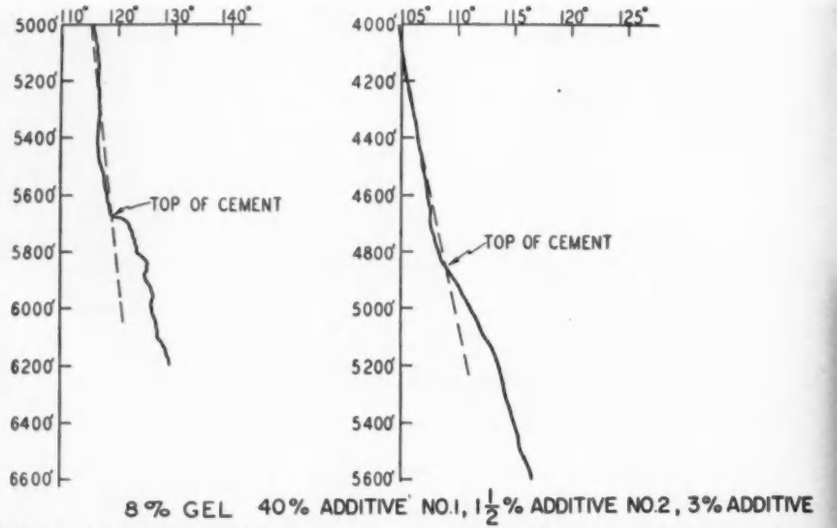

FIGURE 3—These are 12-hour temperature surveys of wells in the same field; one with 8 percent gel cement and the other with additives as shown. The thickening time for the top of the special cement was near 12 hours, and the top is not as prominent as that logged for the 8 percent gel cement.

ment on a temperature survey. The thickening time of the slurry selected should be checked not only to ensure sufficient time for placement at the highest temperature encountered, but to see that there is not an extended thickening time at the top of the cement column. If a long column of cement is being placed, it is possible to use a No. 2 blend which will have a thickening time of 12 hours or greater at the temperature at the top of the cement column. This will prohibit a successful 12-hour temperature survey. No special problem other than consideration of this point is created since a blend can usually be picked which will offer adequate bottom-hole thickening time and still have a thickening time of about six to eight hours at its top. Such a cement blend can be readily detected on a temperature survey run 12 hours after cementing. Figure 3 illustrates a No. 2 cement temperature survey and an 8 percent gel temperature survey in the same field. In this case, the thickening time at the top of the cement column was near 12 hours, and only a slight indication of the top of the cement can be seen. Figure 4 is a No. 2 cement 12-hour temperature survey on which the thickening time at the top of the cement column was near six hours. A much greater indication is seen here.

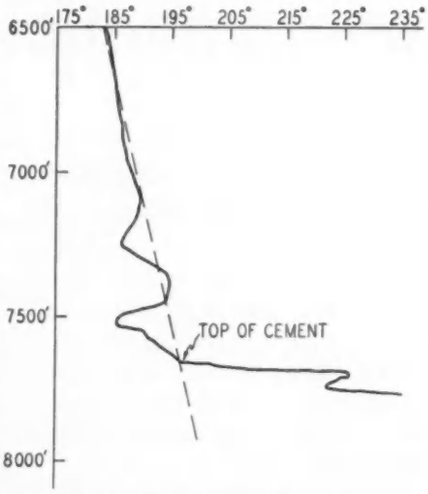

FIGURE 4—This is a 12-hour temperature survey on a well using all of the special additives in the slurry. The thickening time at the top of the cement column was nearer six hours and the top of the cement gives a much greater indication than the well shown in Figure 3.

Throughout this article, the time periods mentioned are those which are standard with Phillips. It is Phillips' practice to release pressure on the casing 12 hours after cementing in order to run a temperature survey or nipple up. Drilling out or the start of the completion procedure comes 24 hours after cementing. Other operators with different standards will naturally have different requirements.

The desirability of selecting a particular blend or blends of cement for each well or field has been emphasized throughout this paper. This is not because of any special limitations of the special systems; but, rather, represents a general concept of good cementing practice.

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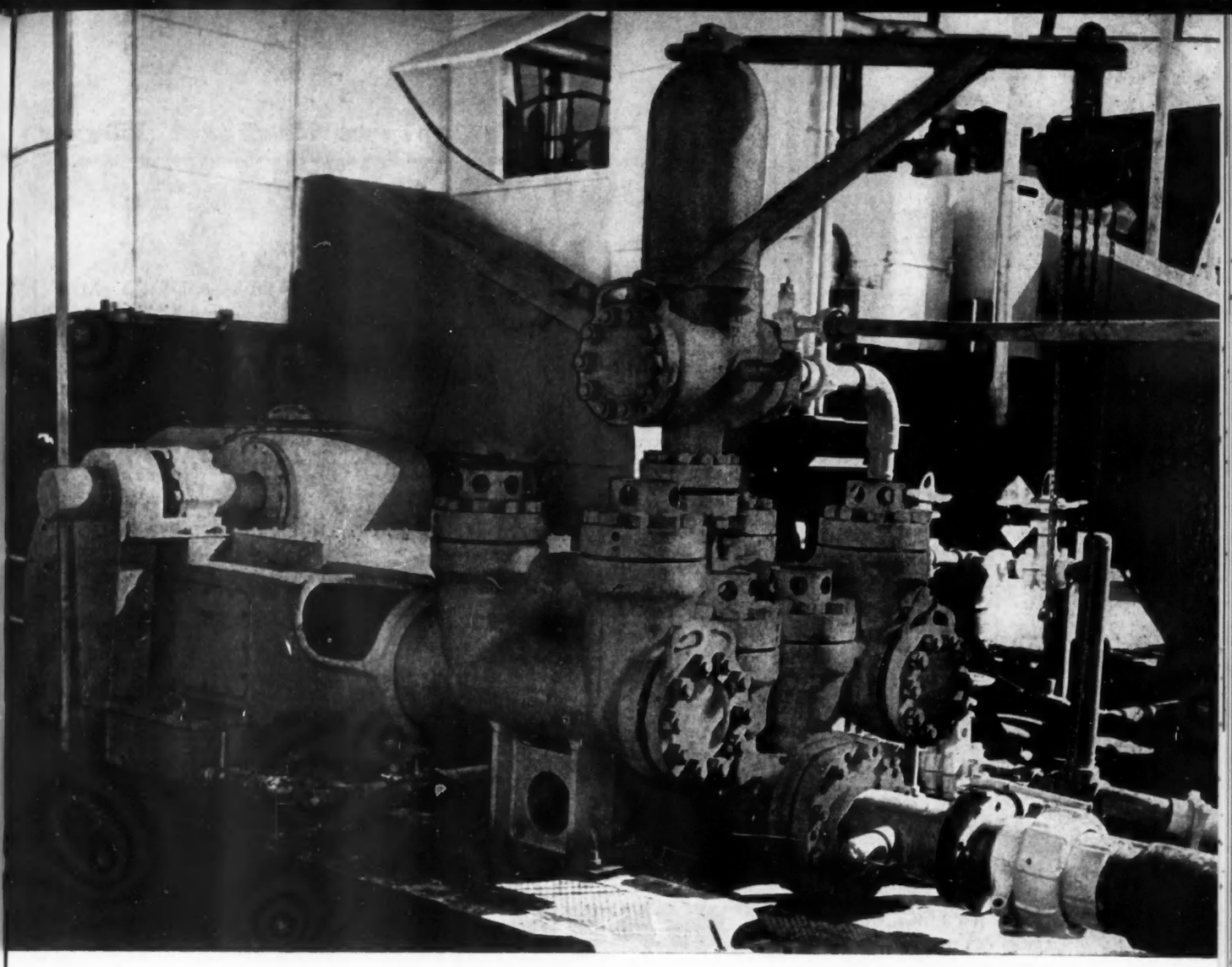

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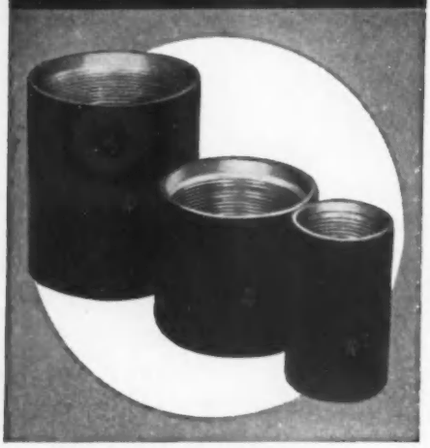

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   a. 1.65 b. 7.0 c. 35.5.
2. The cost of weight material in 100 barrels of 17 pounds per gallon mud is:
   a. $100 b. $500 c. $1200.
3. The pressure at which the API filter loss test is determined is:
   a. Viscosity; b. Chloride content; c. Basicity.
4. Phenolphthalein is the indicator in the:
   a. alkalinity test b. sulfate ion test c. calcium ion test.
5. Match the chemical in one column with its formula in the other column.

a. Caustic soda	1. $Ca(OH)_2$
b. Soda ash	2. NAOH
c. Slaked lime	3. $CaSO_4 \cdot ½ H_2O$
d. Plaster of paris	4. NACL
e. Salt	5. NA_2CO_3

ANSWERS

1. a; 2. c; 3. b; 4. a; 5. 1 (c), 2 (a), 3 (d), 4 (e), 5 (b).

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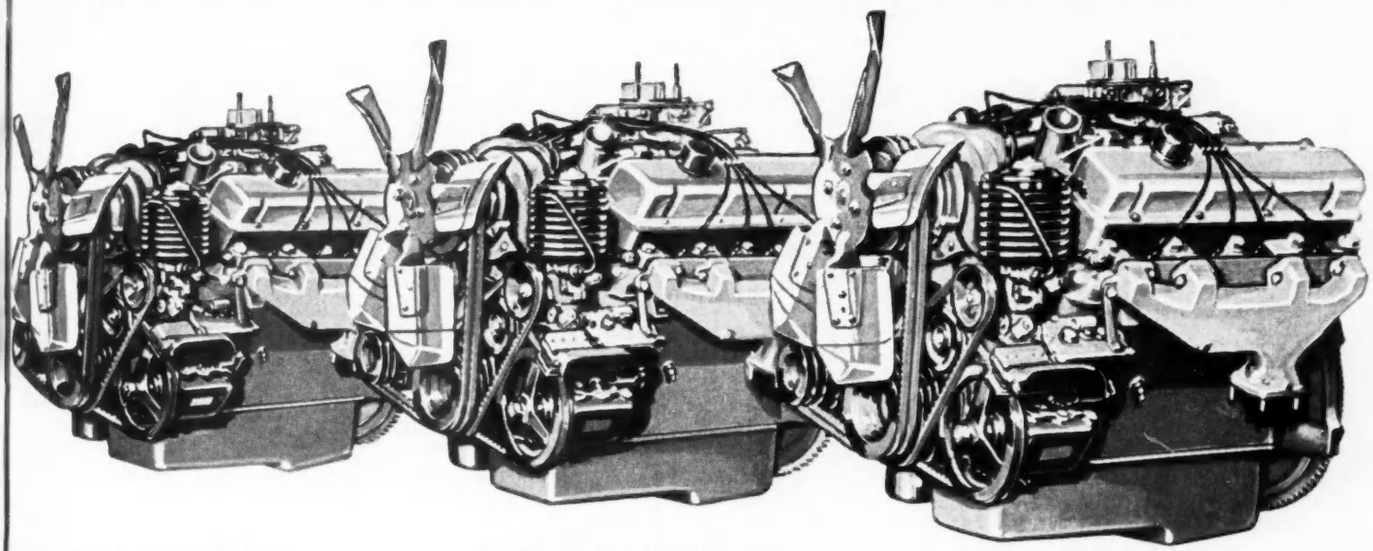

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New Solution Proposed for Dual Completions in Citronelle Field

A single tubing string with one-way valves will allow production from upper and lower zone to commingle without possibility of return flow to formation.

By H. Gene White, Petroleum Engineer,
and Robert C. MacElvain, Petroleum Specialist,
Alabama Oil and Gas Board, University, Ala.

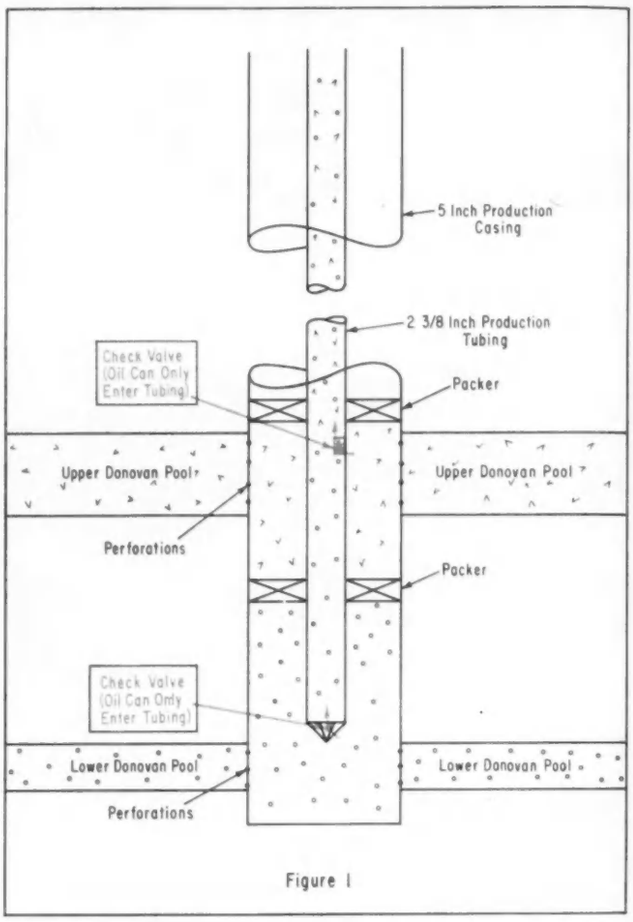

Figure 1

This is suggested as the answer . . .

The diagram above shows the downhole equipment hookup for "Scotch commingling." One-way valves allow the oil from the upper and lower zones to enter the one string of tubing, but prevent the oil from flowing back into the formation. No special

ONE OF THE major problems in the Citronelle field of Alabama has been the difficulty in finding an efficient method of dually-completing two deep zones through one borehole.

The upper zone found between 10,850-11,000 feet, consisting of as many as seven oil sands, is called the Upper Donovan Pool and is thought to be in the Rodessa formation of Lower Cretaceous age. There are also as many as seven pay sands in the lower zone or Lower Donovan Pool, found between 11,250-11,500 feet, and thought to be the Bailey formation. The two zones are only 200 feet apart, and are separated primarily by dense shale with sandy streaks. The rather great depth rules out the possibility of drilling one well for each zone on every 40-acre unit. State regulations require that the upper and lower reservoirs be treated as separate units and the production separated. All of these factors combine to create a real problem to producers in the field.

The engineering problem caused by the state's regulation for separate production of the two zones is simply that each pool must be produced through just one well bore as though each pool was a separate and distinct field. The economic problem is not quite so simple.

The Bailey, or lower zone, consists of six or seven intermittent sand lenses, and does not consistently underlie the Rodessa formation. The Bailey sands lense out without any apparent pattern just as can be expected of sands which have been deposited under near shore conditions. This makes the task of drilling a well into the Bailey sand a very uncertain proposition. These uncertainties are further over-shadowed by many other factors even when the Bailey sands are present.

The Bailey development at Citronelle has many of the aspects of a wildcat venture. The cost of drilling through and completing the lower zone, after the upper zone has been reached, entails an extra expense of approximately $63,000. This means that a dual completion at Citronelle costs more than half again as much as a single zone completion. The average daily production from the lower zones for the month of September 1957 was only 42.3 barrels per day.

Since the entire field is made up of

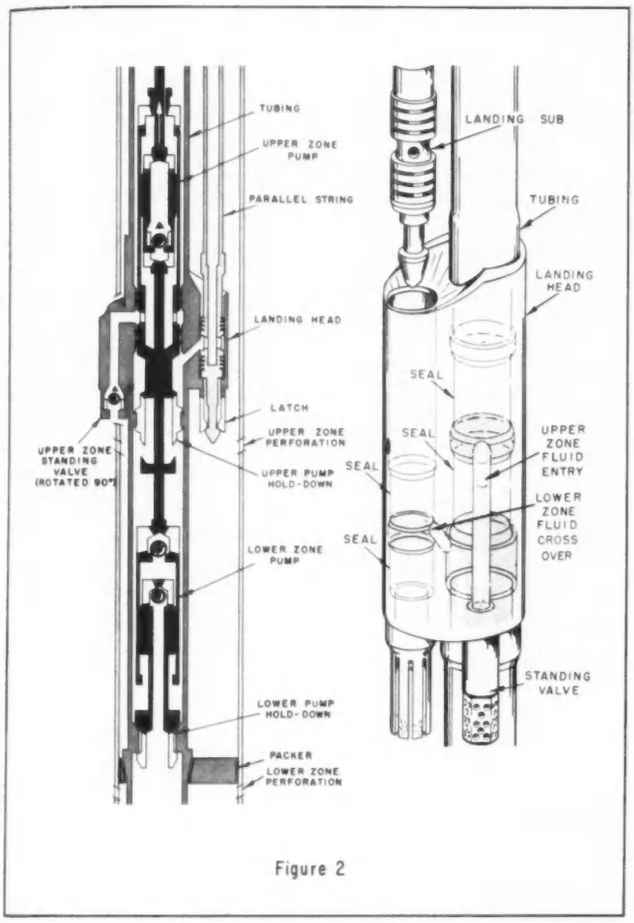

Figure 2

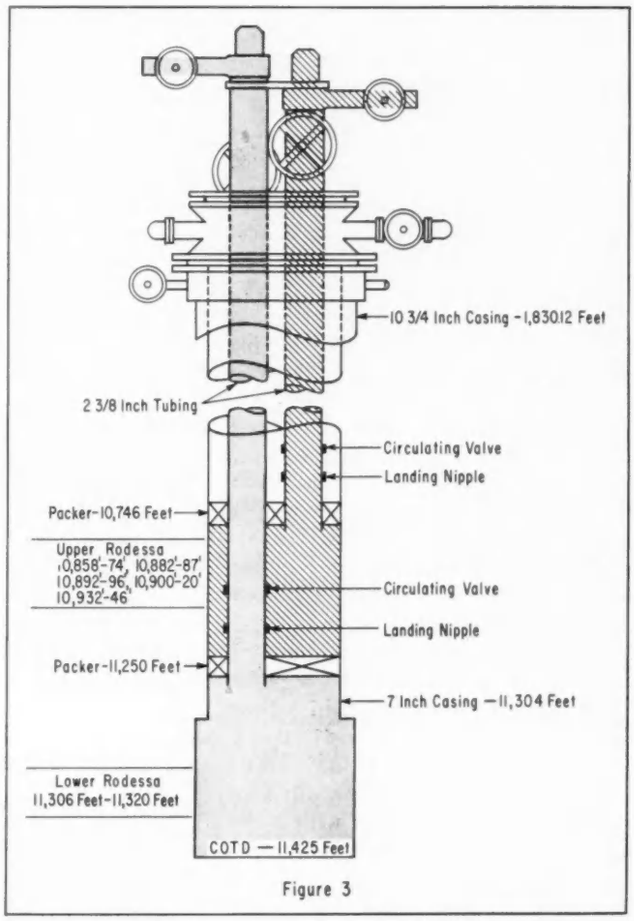

Figure 3

These are the costly completion methods now being used in Citronelle field

or unusual equipment is required. Figure 2 shows how one company has both pumps actuated by a single sucker rod assembly. A crossover assembly prevents oil of the two zones from combining and both zones are produced separately. Initial cost is staggering. Both zones must be shut down in order to work on one. At right is conventional method of completing dually in Citronelle field. This method requires two strings of rods and two pumping units. Major objection is installation expense of two pumping units, two strings of tubing and more elaborate fittings and mountings.

rather tight sands, becoming even tighter towards the field's periphery, the water table can only very feebly exert itself through the rim of impermeability surrounding the field. Such a water drive is of insufficient magnitude to be considered a recovery mechanism. Therefore, there is very little chance that anything can be recognized at Citronelle as a primary recovery mechanism except fluid expansion. In this case the oil is forced into the bore holes by the expansion of the oil, the connate water, and even the containing rocks themselves by the force of the weight of the two miles of sediments which overlie the Rodessa and Bailey sands.

Since the gas-oil ratio (50 to 1) and the bubble point (580 pounds) are low, there is no assistance from an expanding gas in the recovery mechanics.

It is not a unique situation, but it is unusual that although there are water sands present between the two zones, there has been no encounter of formation water even as far out as three miles from the center of the field. There can be little doubt that there is water present further out, but with fluid expansion persisting as the primary recovery mechanism, only a very small percent of the in-place oil can be expected to be recovered. A plot of cumulative production against bottom-hole pressure yields a straight line with a slope that is steep enough to indicate a short life for the Citronelle field under its primary recovery mechanism. Secondary recovery already appears as the next big hurdle for Citronelle. But the question here is that of dual completion, and such facts and considerations as all of the above have placed many hazards in the path of dual completions.

Good engineering and good economics are inseparable at Citronelle, but the economic risks in aiming for completions in the lower zone have become so severe that they affect every operator in the field, resulting in an almost complete trend away from dual completions. Gulf Oil Corporation, the largest operator in the field, was the leading proponent of dual completions during the early development. At that time, Gulf drilled all of its units with every endeavor to dually produce each well. But since that time, Gulf has completely abandoned the intention of further dual com-

pletions in favor of single completions only. With the rapid decline in bottom hole pressures, wells drilled now may never pay out. The single-zone trend could result in a no-zone trend, with some of the offset units summarily abandoned prior to the complete development of the field. The ever increasing ratio of single completions to dual completions (76 to 24) is certainly giving Citronelle a very ragged appearance. All of the single-zone completions except one are finished in the upper pool only. This upper zone is generally considered to be the best and most productive. However, much of the production evidence indicates that the lower zone of many wells is equally as good or even better in some cases than the upper pay. Almost all of the wells have sands in both zones. Even when one of the zones is marginal, there is always some recoverable oil.

The present single zone trend at Citronelle is based upon the following theory. Produce only the upper zone until depletion; then produce the lower zone. This theory may waste a great deal of Citronelle's oil. Operating costs will catch up with every well pumping solely from the upper zone long before that zone is depleted. The day must finally arrive for every such well when its upper zone will have to be squeezed or packed-off. The endeavor will then be made to produce from the lower zone which may have become marginal at that late date. If the lower zone turns out to be non-commercial, the entire well must be abandoned. In this process, a lot of Citronelle's oil is also abandoned.

We cannot turn hopefully to the possibilities of fracturing in this instance. This has already been tried on a number of wells, but with indifferent success. It certainly has not contributed significantly to the production in the Citronelle field.

The conventional method of completion is shown in Figure 1. Two types of pumps are being used with this setup, a hydraulically actuated down-hole pump and the standard rod type pump. The major objection to this type of pumping arrangement is the initial expense of installation since two pumping units are required and two strings of production tubing, along with the much more elaborate fittings and mountings. A second objection is the difficulty in working over one completion without interfering with the other completion. The complicated and necessarily awkward arrangement of a two zone pumping apparatus creates a high percentage of shut-in wells for work-over operations due to the high rate of mechanical failures. Although this type of operation does work, it has proven itself to be extremely troublesome and of doubtful economic justification.

One company has both pumps actuated by a single sucker rod assembly (Figure 2). A crossover assembly prevents the oil of the two zones from combining, and both zones are produced separately. Here again, there is the staggering initial cost and the absolute necessity of shutting down both zones in order to work on one of them.

The great expense in the above described completion methods is seemingly unavoidable, and no further refinements or innovations are being investigated by the Citronelle operators at the present. At one time the idea of commingling production was voiced by a very small minority of the operators, but no action was taken. It was demanded by most of the Citronelle operators that "the contents of one zone under all circumstances must be prevented from entering another zone." This very statement suggests an answer to the problem.

For lack of a better name, we shall call this proposed method of dual completion, "Scotch-commingling," for it is neither Scotch nor commingling. But it is a money-saving process and the oil from the two zones is not produced entirely separately. The loudest argument against ordinary commingling is that the contents of one zone are not prevented from entering another zone. This objection is eliminated in Scotch-commingling by simply packing-off the upper zone and running only one string of production tubing through the packing arrangement of the upper zone and into the lower zone. The production tubing would have one check valve at the bottom adjacent to the lower zone and another check valve adjacent to the upper zone (See Figure 3). These check valves would permit oil from both zones to enter the production tubing from their respective sumps, but would prevent any oil from reversing its flow once it has entered the tubing. A one-way circuit would exist, and although the oil from the two zones would be able to mix freely within the production tubing, it would not be possible for the contents of one zone to enter another zone. Thus, you have "Scotch-commingling," for which no special or unusual equipment is required.

This method of dual completion would entail only a minor expense over and above the cost of completing the upper zone. Smaller diameter and less expensive production casing could be used. One pump, one string of sucker-rod, and one entire string of production tubing could be dropped from the dual completion process altogether. Other savings would result from the use of simpler fittings and mountings. Such a low cost method of completion might give an enormous economic boost to the operation and development of the Citronelle Field. More important still, all of the oil

Continued on Page 78

H. G. White

R. C. MacElvain

About the Authors

H. Gene White graduated from the University of Alabama in 1957 with a B.S. degree in mining engineering, with petroleum and natural gas engineering option. Before graduation he attended the U. S. Merchant Marine Academy from 1948 to 1950 and was a member of the U. S. Air Force from 1951 to 1953. He has been employed as petroleum engineer with the Alabama Oil and Gas Board since last year.

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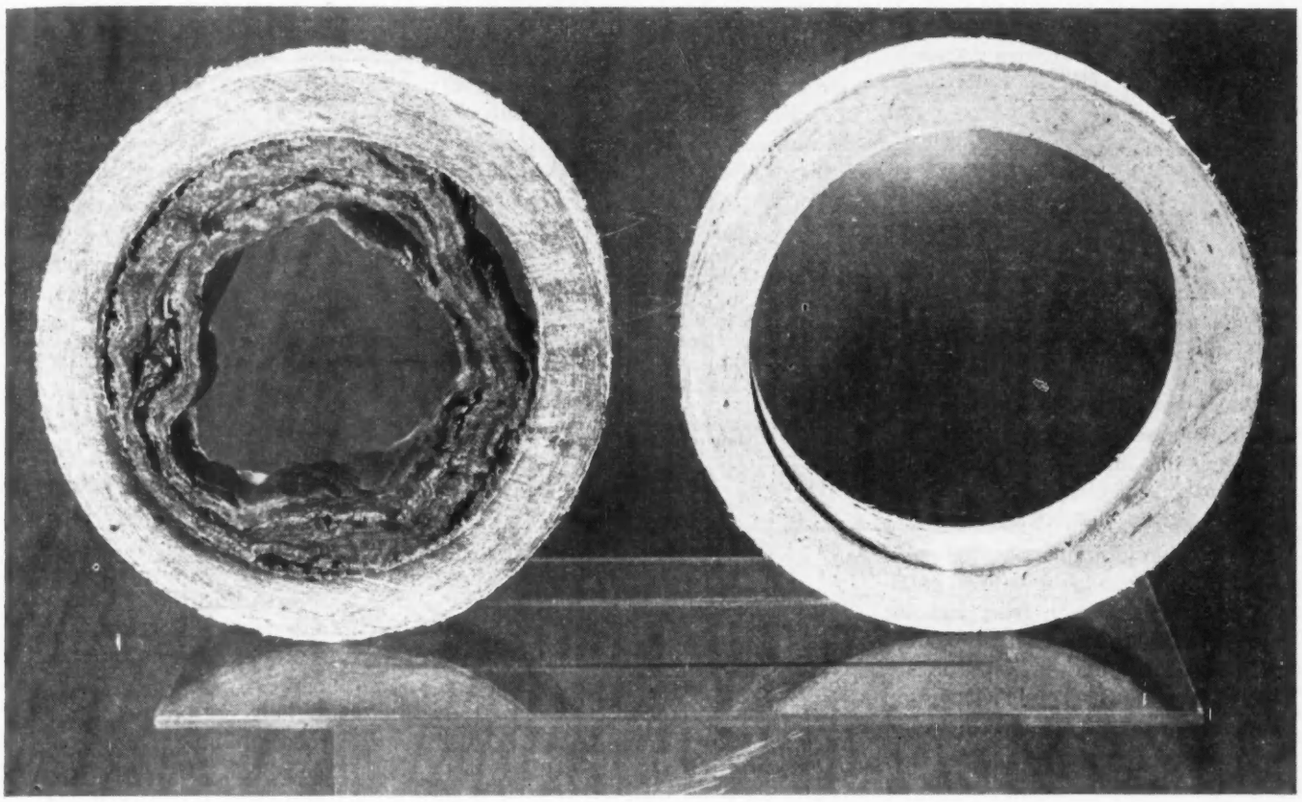

FIGURE 1—These sections of transite pipe illustrate the effectiveness of cleaning salt water disposal lines chemically. Both sections were cut from the same length of pipe. The section at left shows scale deposits in the line before it was cleaned. The section at right has been cleaned.

Maintenance of Salt Water Disposal Lines

Acid solvents remove scale deposits, keep lines at high operating efficiency.

By B. G. Cunningham
Dowell Incorporated
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PARTIAL PLUGGING OF salt water disposal lines by accumulated scale deposits is a common oil field occurrence. The high mineral content of produced brines results in heavy deposition on interior pipe walls, thus reducing the capacity of the lines. A method of chemically cleaning such lines has helped solve the problem of keeping them at high efficiency.

This method of removing scale deposits consists of applying acid solvents. The lines are filled with solvent, which reacts with the mineral deposits until it spends. Successive stages of solvent are applied until all scale has been removed. In most cases, the complete cleaning operation requires only four to six hours.

Deposition in Transite Pipe. Cement-asbestos (transite) pipe is ordinarily used for salt water disposal lines because of its resistance to corrosion, both chemical and electrolytic. Using transite pipe also eliminates tuberculation, another problem common to metal pipe. Tuberculation is caused by accumulations of corrosion products around active anodic areas, or points having positive electrical potentials. The resulting nodules of rust-like materials reduce the carrying capacity of the pipe.

The major problem in maintaining transite salt water disposal lines is keeping the inside of the pipe free from scale accumulations. Such scale usually consists of mineral deposits, predominantly calcium carbonate, with traces of magnesium and sodium silicates, and sand. Organic deposits (oil and paraffin) are often present.

Table 1 shows the analysis of a salt water sample from a Texas oil field. The high mineral content of salt water often results in heavy scale deposition; such deposition may be caused by changes in pressure or temperature, or, in some cases, by mixing of incompatible brines.

The composition of different deposits may vary, depending on the chemical content of the brine pumped through the disposal lines. Therefore, scale samples should be analyzed so that the cleaning treatment can be properly planned. The approximate amount of scale present in the line can be calculated from the average thickness of the scale sample and the

TABLE 1
Analysis of Salt Water From a Texas Oil Field

COMPONENT	Amount (ppm)
Calcium	3,210
Magnesium	638
Sodium	38,960
Chloride	59,980
Sulfate	Trace
Bicarbonate	210
Iron	Trace
Ratio of calcium choride to magnesium chloride	3.56
Specific Gravity at 76°F	1.076

length of the line to be cleaned. From this information, the type and amount of solvent and the best cleaning procedure can be determined.

When calcium carbonate forms a major portion of the scale, its rapid reaction with the acid causes much of the scale to slough from interior pipe walls, so that it can be carried out of the line in the spent solvent. In all cases, however, sufficient acid is used to insure complete removal of the deposits.

Cleaning Procedure. The usual procedure in cleaning a salt water disposal line has been to flush the line with fresh water to remove salt water and any loose sand that might be present. The line is then filled with an acid solution (4 to 5 percent). This low concentration is used for the first stage to prevent rapid evolution of large amounts of gas, which could result in foam that would prevent fresh solvent from contacting the scale. The solvent is allowed to react until spent, after which it is displaced with fresh solvent.

When this second solvent stage has reacted, it is displaced by a 10 percent acid solution. This stronger concentration can be used because the rapidly reacting components of the scale have been removed in the earlier stages. The acid is left in the pipe for four hours, or until successive samples show that the solvent has remained at a constant strength for an hour. When all the scale is dissolved, the acid is flushed from the line with fresh or salt water.

Because cement, a major ingredient of transite pipe, is attacked by acid, it might be expected that transite pipe itself would be damaged by acid during cleaning treatments. During the manufacturing process, the basic ingredients of transite pipe (asbestos fibers, cement and silicate) are consolidated under extreme pressure to form a dense, homogeneous structure. The pipe is then treated by a steam curing process. During this treatment the silicate unites chemically with the free lime in the cement and produces a highly stable calcium silicate. This material resists the action of acid.

TABLE 2
Weight Loss In Pounds Per Linear Foot of Pipe

Solvent	1st Two Hour Treatment	2nd Two Hour Treatment	3rd Two Hour Treatment
5%	Scale Removed	0.145	0.137
7½%	Scale Removed	0.229	0.188
10%	Scale Removed	0.302	0.267

Table 2 shows the results of laboratory tests in which sections of four inch I.D. transite pipe were subjected to various concentrations of acid solvent during three successive two-hour periods. Visual examination revealed no appreciable attack of the pipe by the acid. Measurements of interior sufaces proved that less than $\frac{1}{64}$ of an inch had been removed from the pipe walls during the three successive exposures.

Case Histories. Four thousand feet of four-inch transite disposal line was cleaned by this method using two thousand gallons of 15 percent acid solvent. The line was out of service for six hours, and the total cost of the cleaning operation was approximately $675. All scale deposits were removed.

A 1000-foot salt water disposal line was cleaned using 500 gallons of 15 percent acid solvent. All scale was removed and the line was out of service for only four hours. Cost of the cleaning treatment was about $400.

A six-inch salt water disposal line, 5000 feet in length, was cleaned using 2500 gallons of 15 percent acid solvent. The line was out of service about ten hours, and the cost was approximately $750. No deposits remained after the treatment.

About 15 tons of scale was removed from a salt water disposal line, 12,500 feet in length. The four-inch and six-inch transite pipe was so badly scaled that salt water could not be disposed of as rapidly as it was produced. This line was restored to full capacity in 26 hours at about one-fourth the cost of laying a new line. —**The End**

New Solution Proposed

Continued from Page 76

sands not now considered to be commercial could be effectively tapped and efficiently drained. The ultimate recovery should climb tremendously. It may be well to bear in mind that there is not now any tangible objection to this method nor is there any definite regulation prohibiting such a method of completion. Regardless of how the production from the Upper Donovan Pool or Lower Donovan Pool is obtained, states Rule 6 (a) of the Citronelle Special Field Rules, "appropriate down-the-hole equipment shall be installed in such a manner so as to prevent commingling of production within the well bore, etc." Commingling would occur in the production tubing, but not in the well bore.

Since there would be no way in which the daily production from each zone could be exactly tabulated, there arises the one point which affects such a dual completion. That is that such wells under the present field rules would be forced to accept the smallest allowable allotted to the poorest pool. This would be unrealistic and would have a punitive effect on wells dually completed in the above described manner. The total allowable under "Scotch-commingled" wells should be changed upward to at least 200 barrels or more per day. The artificial pressure fluctuations in the respective sumps due to pumping would control the relative amount of oil pumped from each pool. Certainly this would be less of a drain and hardship on the same formations which are presently held to the stiff and formal demands of an arbitrary allowable. These rigid and predetermined allowables cannot take into consideration that many wells are making a maximum effort, and still are unable to pump the allowable.

It is maintained that this proposal for dual completion is a sensible and realistic plan designed to be of assistance and benefit to the operation and development of the Citronelle field. And it is hoped that the problem of the daily production tabulation will not affect its acceptance, for after all, such an objection has its basis in the illogical reasoning that the Bailey oil is best left in the ground if it cannot be brought to the surface in the usual fashion. —**The End**

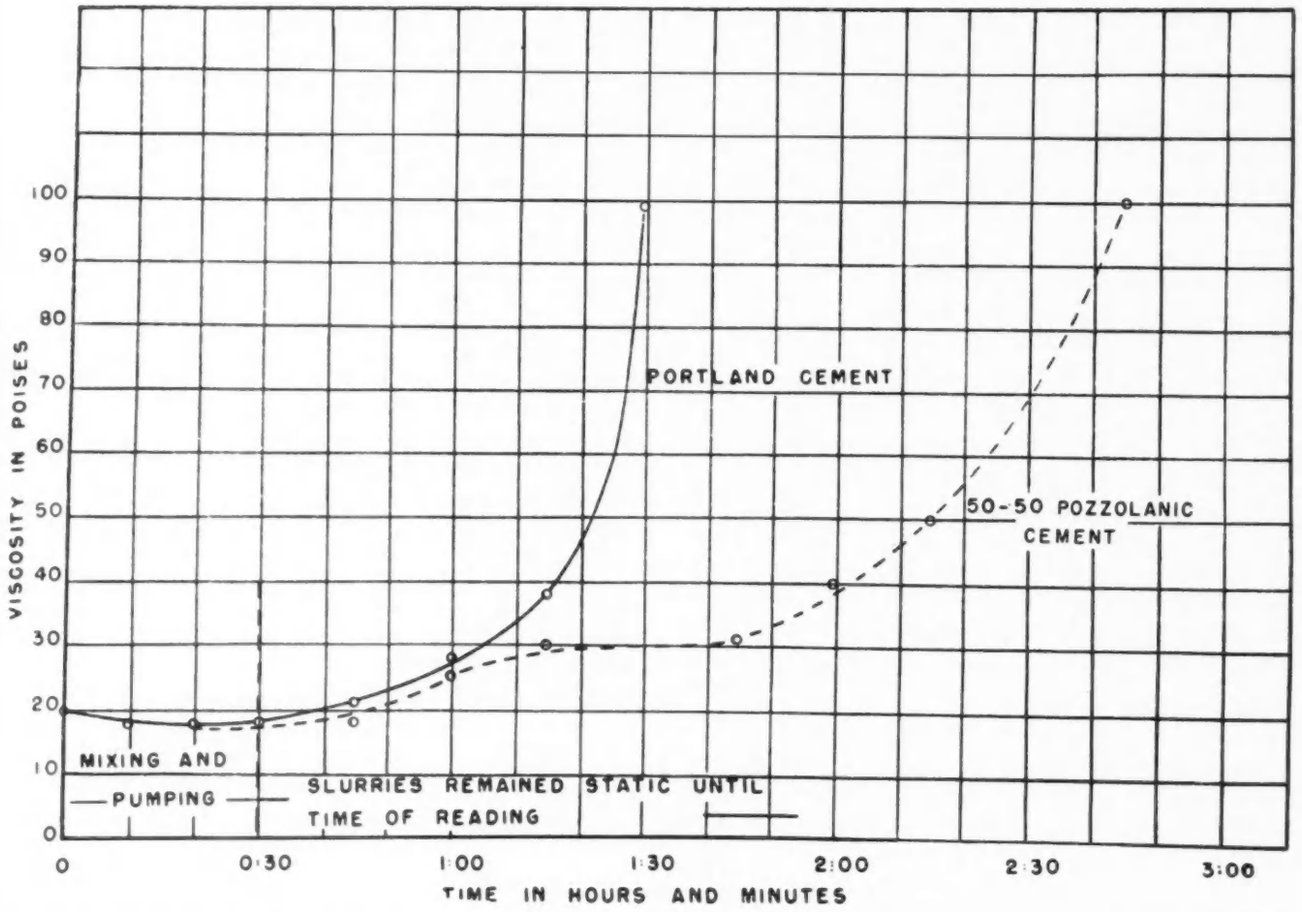

FIGURE 1—When agitation of a neat cement slurry is discontinued, a rather rapid gelling action takes place and additional force is required to resume fluid movement. With pozzolan-cement slurries, movement can be resumed after considerably longer periods of shutdown with no appreciable increase in pressure.

Pozzolanic Slurries for Injection Wells

Survey of more than 100 wells in western Kansas indicates many advantages, including: lower pumping pressures, high fill-up without formation breakdown and good bonding properties with pipe and formation.

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AMONG CEMENT slurry developments of the last ten years there is one composed of a mixture of portland cement and a pozzolanic material which seems to have given marked results in water-flooding operations, especially in the Kansas-Oklahoma area.

Pozzolans have been used extensively in mass concrete projects, such as dams, to obtain special properties and in recent years large quantities of these materials have been successfully blended with portland cement for use in many oil well cementing applications, from surface pipe to oil strings in wells as deep as 12,000 feet or more.

Basically, the objectives of cementing water flood wells seems to be to prevent vertical migration of fluids behind the pipe and to exclude undesirable fluids from contact with the casing, thereby preventing corrosion. It is apparent that for shallow wells such as these, the standard considerations of thickening time or pumping time, setting time, and compressive

strength are not necessarily the major factors in selecting a slurry since thickening times for most slurries are quite adequate at low temperatures and the other two items can be reasonably well controlled in slurries which would be considered for use in the shallower wells.

The important considerations for water flooding apparently become, then, distribution of cement in the hole without channelling and good bonding properties with both the pipe and the formation to prevent fluid migration. Another factor which should be evaluated is the initial cost of full hole cementing when balanced against the possibility of repair work over the full span of life for the well. No matter what completion is selected, fresh cementing materials will be an aid to securing better slurry mixing and superior cementing jobs.

Neat Cement. Because of its availability and the fact that it has some of the properties desired for well applications, neat cement was the first cementing compound used for oil well cementing. It is still used today although technological advancements have introduced many new additives to improve its inherent limitations. Cement failures are often difficult and expensive to correct, with the possibility always present that well producing capabilities may be damaged during repair operations.

High heat of hydration, when the cement hardens, is a potentially harmful characteristic of neat cement. It results in a temperature rise as the cement sets and a temperature decrease as the reaction slows down and the heat is dissipated to the adjacent formations. While neat cement does develop high initial compressive strengths, it is quite brittle and subject to cracking and shattering which could destroy its usefulness in preventing fluid migration.

Another inherent problem with neat cement is the fact that when the cement and water react in the hydration or setting process of the cement, lime is liberated. This lime adds nothing to the cementatious value of the set cement and is water soluble so that there is always the possibility that various waters contacting the cement may leech or dissolve the lime. This could leave a cement column of a less dense nature or of increased permeability through which water could enter, allowing corrosion of the pipe. The thixotropic properties of neat cement, though not as pronounced as in gel-cement, do cause a viscosity increase or gelling of the slurry and another undesirable factor is introduced into the cementing job.

Pozzolan Cement. A pozzolan is defined as a siliceous and aluminous material which in itself possesses little or no cementatious value but will, in finely divided form and in the presence of moisture, react with hydrated lime at ordinary temperatures to form cementatious compounds. This chemical reaction is the basis for the use of pozzolan cement mixtures, since the lime liberated when cement hydrates is of no value in the set cement but by reaction with the pozzolan, both these materials become cementatious themselves.

Types of Pozzolan. There are two basic types of pozzolans: Natural pozzolans, which are generally of volcanic origin, and artificial pozzolans, which are silicates that have been subjected to high heats during manufacture. Within these two types of materials there are many sources, some of which give pozzolans that are much more reactive than others. Because the factors which control the pozzolanic reaction are not too well understood, quality control on these materials must, at the present time, be by means of laboratory testing. It should be recognized that many reactive silicates which will fit the generalized definition of a pozzolan do not have sufficient reactivity to be suitable for practical usage as such.

Both types of pozzolans have been used extensively as oil well cements to overcome many problems attendant to completion. However, the artificial pozzolan, a material commonly called "fly ash," will be the one discussed in this article because it is the type generally in use in the Kansas-Oklahoma area. This pozzolan is the combustion product resulting from the burning of pulverized coal in steam generating plants. It actually consists of the inorganic impurities in the coal which will not burn and so pass through the furnace with the flue gases. A typical analysis of a good quality fly ash is as follows:

Silicon Dioxide	—	40.54%
Aluminum Oxide	—	18.51%
Iron Oxide	—	23.19%
Magnesium Oxide	—	1.05%
Calcium Oxide	—	6.31%
Sulfur Trioxide	—	1.55%
Loss on Ignition	—	2.76%
Passing 325 mesh sieve	—	93.8 %

Mixtures. Many ratios of pozzolan and cement can be adapted to conform to a variety of well conditions depending upon well temperature and the time at which the slurry should attain sufficient strength to resume operations. The blend which has shown the most versatility in meeting problems not only of deep wells but also shallow wells and still retain the maximum desirable charcteristics, has been a 50-50 mix by volume, wherein the ratio of pozzolan to free lime is at an optimum for ultimate strength buildup and durability. Both laboratory tests and field experience have shown this slurry will retain its valuable properties when used with many of the additives currently used with portland cement.

In most applications a superior job can be expected from a mixture of pozzolan and cement because of improved workability and reduced gelation of the cementing slurry. When agitation of a neat cement slurry is discontinued, a rather rapid gelling action takes place and additional force is required to resume fluid movement (Figure 1). With pozzolan-cement slurries, movement can be resumed after considerably longer periods of shutdown with no appreciable increase in pressure.

This again has been proved not only in the laboratory but also in field tests where only nominal pressure buildup occurred on resuming circulation after a 30-minute shutdown test. This lack of thixotropic gelling can also be translated into a better job because the relative lack of increased viscosity on standing allows the slurry to more easily conform to the shape of the well bore thus giving a better coverage and bond with the adjacent formation.

Cement channelling, because of gelled cement slurries, should be reduced and field jobs to date indicate that more efficient mud removal is obtained when pozzolans are used. An additional factor is that where desired, lower water ratio slurries can be utilized with much less trouble when using pozzolan-cements, and the

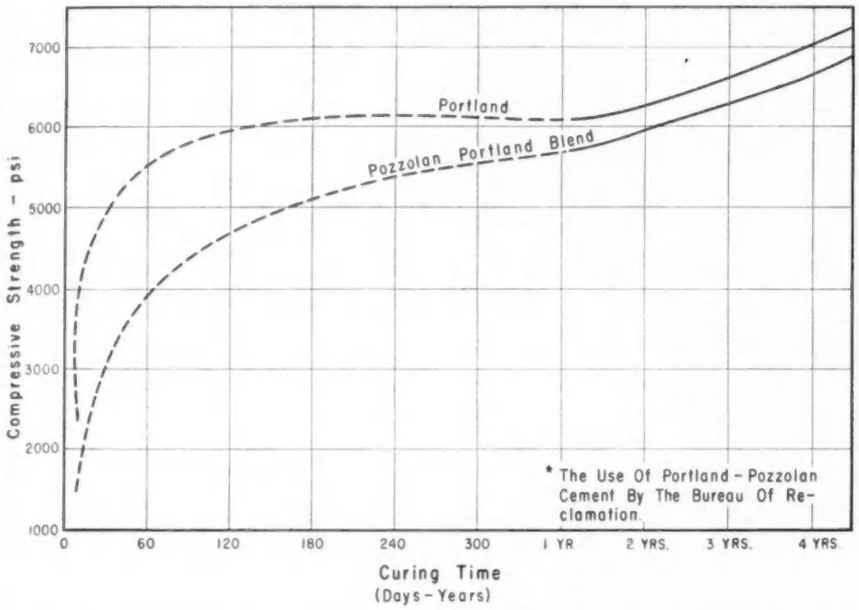


FIGURE 2—There is not much difference in the amount of heat of hydration of neat cement and pozzolan-cement, the slower reaction rate of the pozzolan causes less temperature rise and the slower heat liberation is more favorable to the curing of the hardened slurry. The pozzolan-cement blends ultimately approch or exceed the neat cement in compressive strength.

higher percentage of cementatious material can be extremely advantageous when a relatively small vertical height of cement is to be placed.

Bonding Properties. Better bonding of the slurry to the pipe is obtained by the use of pozzolans, partially because of the improved workability mentioned before and because of increased expansion on setting and the lower heat of hydration which reduces expansion and contraction caused by temperature changes. Although there is not much difference in the amount of heat of hydration of neat cement and pozzolan-cement, the slower reaction rate of the pozzolan causes less temperature rise and the slower heat liberation is more favorable to the curing of the hardened slurry. The pozzolan-cement blends ultimately approach or exceed the neat cement in compressive strength (Figure 2).

Laboratory tests have been made to compare the expansion of neat cement and pozzolanic cement blends upon setting. These tests indicated that the pozzolan-cement exhibited approximately 50 percent more expansion at seven days. A 1"x1"x10" bar of neat cement cured at 100° F. increased in length by .0040 inches at seven days while a specimen of the same size containing equal volumes of pozzolan and cement in the slurry increased in length .0058 inches at seven days (Figure 3). These data are an average of several test specimens on each slurry. This expansion is not to be confused with that which occurs when cements are exposed to corrosive waters since sulfate water attack on cements generally do not take place at early stages but rather occurs over long periods of time. Also the test specimens were cured in distilled water to avoid any possibility of deleterious reactions.

Strength Ratios. A higher ratio of bonding strength to compressive strength is obtained with pozzolan-cement than with either neat cement or any of the cement slurries containing inert additives. There is no direct correlation between bonding strength and compressive strength which will cover the broad field of cementing materials. However, series of tests are possible whereby identical techniques may be used to compare these properties of slurries. Such a series of tests resulted in the following data:

- For slurries cured at 80° F. and 24 hours the ratio of the bonding strength to the compressive strength for neat cement was 0.064 and for 50-50 pozzolan cement the ratio was 0.216;
- Slurries cured at 140° F. gave ratios of 0.049 for neat cement and 0.174 for pozzolan cement.

The bonding strength does not increase as rapidly as the compressive strength, as indicated by the lower ratios at 140° than at 80°. This trend is consistent with that determined by other investigators in the field of cement research who have measured higher ratios of flexural and tensile strengths to compressive strengths for pozzolan-cement mortars than for mortars containing only cement. As an example of the improved bonding strength obtained by use of pozzolans, many excellent results have been recorded where selective acidizing or fracturing of closely spaced horizons was carried out without communication.

Fluid Resistance. The set cement used in both injection and production wells on a water flood should be resistant to water or any other fluids with which it may come in contact. Many of these waters contain salts which are harmful to neat cement and other slurries normally used in well completions, while pozzolanic cements have long been recognized as offering resistance to many of these corrosive fluids.

Because the pozzolan reacts with the water soluble lime liberated by the hydrating cement, there is no material present that can be dissolved from the set pozzolanic cement by leaching and the set slurry maintains a permanent low permeability and a more dense cementing compound. This limits the possible entry of and subsequent damage by corrosive waters thereby protecting both the cement job and the pipe.

In many water-flood projects where the normal life expectancy is 10 to 20 years, pozzolan cements have been used as a precautionary measure to reduce potential repair jobs due to corrosive fluids behind the pipe and experience has indicated that remedial work was in fact reduced. A recent survey of wells which were cemented through the Dakota formation of Kansas shows that 111 of 141 wells were cemented using pozzolans last year with no repair jobs having been required. Many repair jobs on old wells have been done using the same material in an attempt to eliminate further trouble.

Results. An earlier survey of over 100

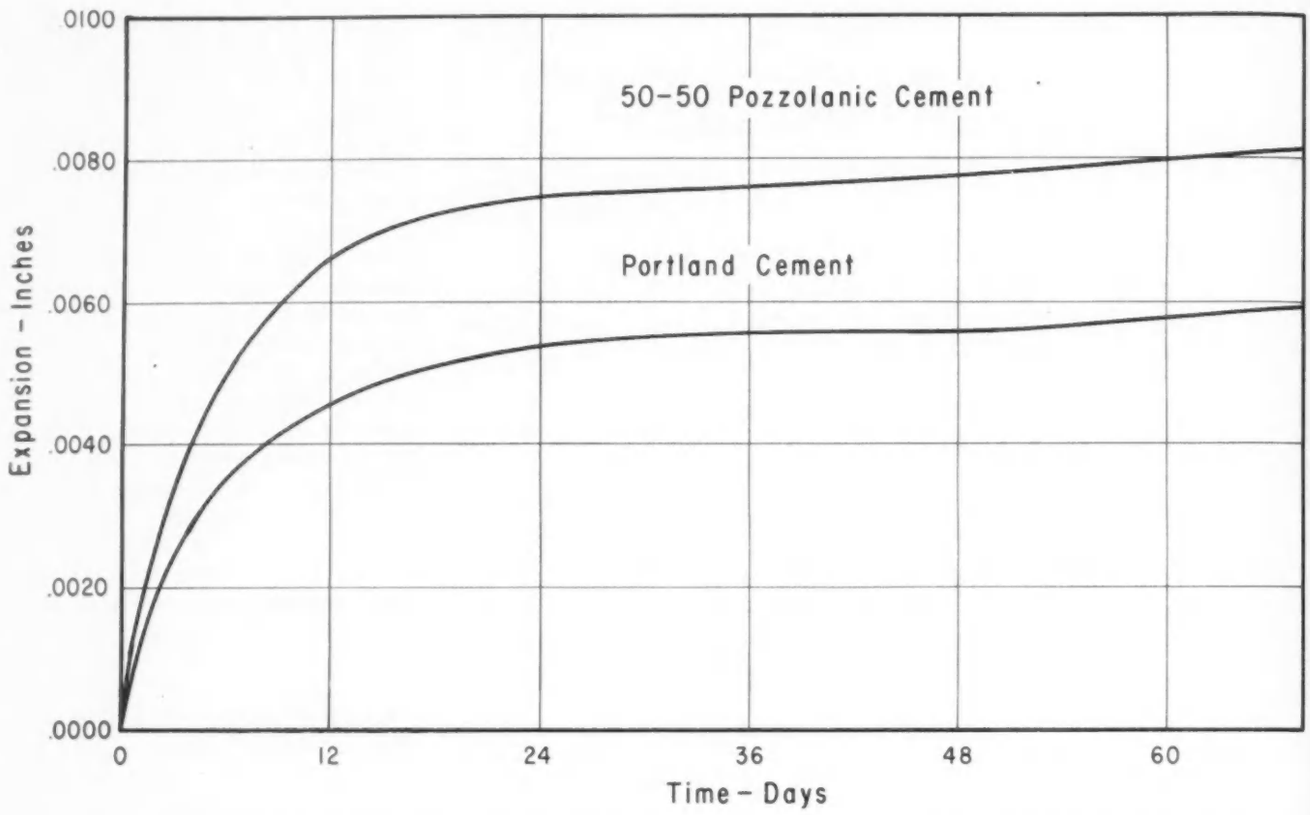


FIGURE 3—Laboratory tests have been made to compare the expansion of neat cement and pozzolanic cement blends upon setting. These tests indicated that the pozzolan-cement exhibited approximately 50 percent more expansion at seven days.

wells in Western Kansas showed the following results:

1. Circulation indicated lower pumping pressures.
2. In difficult areas pozzolan cements gave nearly 100 percent fillup without formation breakdown.
3. Acidizing presented less danger of communication behind the pipe.
4. Cementing jobs were completed at a lower material cost.

Use of cement slurries containing fifty percent by volume of a suitable pozzolanic material should offer the following advantages for cementing injection and production wells, plug backs and surface pipe:

1. Compressive strengths, though lower at early stages, will approach or exceed those of neat cement.
2. Pozzolans are reactive additives and not inert fillers for cement.
3. A relatively low water ratio and a high percentage of cementatious material is placed behind the pipe.
4. Permanent low permeability is gained by virtue of the pozzolanic reaction through utilization of the lime liberated by the cement.
5. Resiliency and lower heat of hydration lessens the possibility of cracking or breakdown in thin section of cement.
6. Superior bonding properties with both the pipe and formation should be attained because of increased expansion and the lack of thixotrophy.
7. The combination of several of the other factors can result in a cementing job that should be less susceptible to corrosive fluids.
8. This premium quality cementing slurry can be used at a lower cost than neat cement. For example: to set 1500 feet of 4-inch pipe in a 6¼-inch hole would require 188.7 cubic feet of slurry. For neat cement this would mean 160 sacks and for a pozzolan cement 150 sacks, making the cost for neat cement $226 as compared to $182 for the pozzolan-cement at one Eastern Kansas bulk station. These figures are for the cementing materials only and further savings can be realized in transportation costs because a sack of pozzolan cement is 10 pounds lighter than a sack of neat cement due to the lower specific gravity of the pozzolan.

Of course, to obtain a successful cementing job requires more than good cementing materials. When cementing in cable tool holes, it is advisable to pump two to three sacks of a bentonite-water slurry ahead of the cement to clean up the hole. This mud should be premixed sometime before the cementing job in order that it not become too thick while it is being displaced and possibly cause channelling of the cement. Also the use of a quantity of mud in excess of two to three sacks would be of doubtful benefit. —**The End**

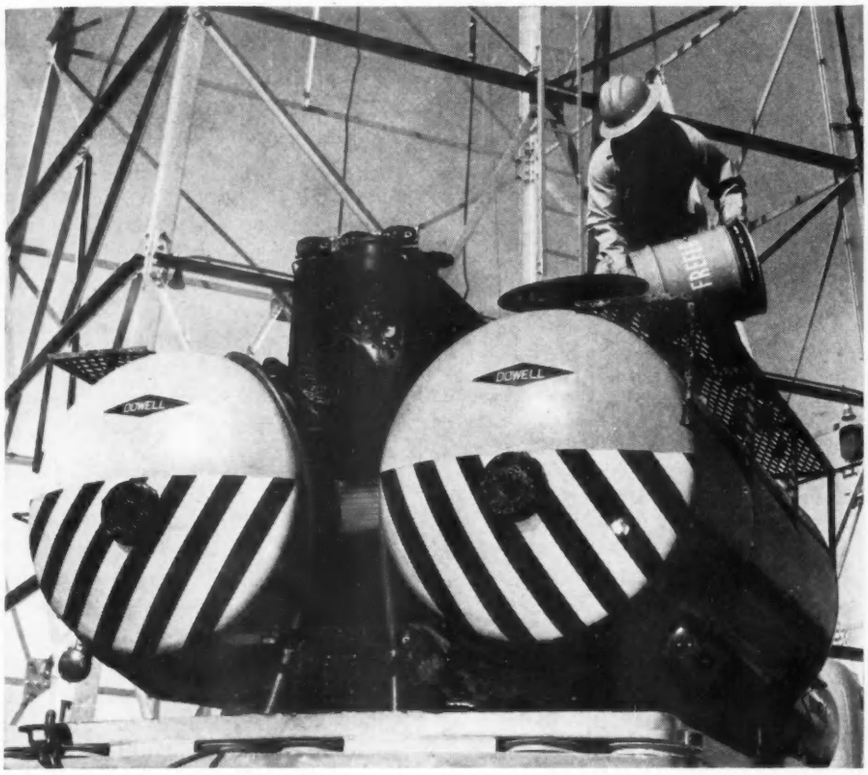


FIGURE 1—Field engineers often remove water blocks from wells with a surface-active agent mixed in kerosine or light crude oil. Such agents can be injected into the formation by pump truck or by hydrostatic pressure.

How to Boost Production By Removing Water Blocks

The results of well treatments for water block are sometimes surprisingly dramatic.

By P. B. Burris
Dowell Incorporated
Oklahoma City

OIL OPERATORS frequently face the problem of removing water blocks or viscous emulsions which have reduced or stopped production. The best solution has often been to treat the well with a surface-active agent that reduces oil-water interfacial tension and breaks emulsions.

Water or oil-water emulsions in the formation usually causes this problem. Water causing blocks may be formation water, filtrate from drilling or completion fluids, or unreturned, spent acid.

Drops of water resist being deformed because of oil-water interfacial tension. The higher the interfacial tension, the greater the pressure required to overcome this resistance in moving the drop through formation pores. A water block results when the total resistance offered by many such drops equals the reservoir pressure. The likelihood of water block increases when an emulsion occurs because of the multitude of drops in the emulsion.

A surface-active agent injected into the formation reduces oil-water interfacial tension. This reduction, in turn, lowers the resistance to movement offered by water drops so that the formation pressure is sufficient to force them out into the well bore. By reducing interfacial tension, the surface-active agent also attacks and breaks down stable emulsions, allowing them to be produced out of the formation.

It is fairly certain that emulsions do not naturally occur in oil sands, but form when the oil emerges into the well or during lifting to the surface. An emulsion may form in the well and then be forced back into the formation.

An emulsion is a mixture of two immiscible fluids, one of which, the inner phase, exists as tiny droplets surrounded by the other fluid, known as the outer phase. In order for an emulsion to form, these two conditions must exist:

1. Oil and water agitated together
2. Stabilizing agent present.

An emulsion cannot be maintained unless the interface is coated with or contains some type of stabilizer. Some of the common stabilizers are clay, sand, paraffins, asphalts, and natural surface-active materials. Such surface-active materials are usually polar molecules, one pole of which is oil soluble, the other water soluble. The molecules arrange themselves around the inner phase of the emulsion, with an end in each fluid, thus forming a protective, stabilizing film. A stable emulsion within a formation often causes a partial or complete water block.

The surface-active agent attacks emulsions in two ways:

1. It introduces new polar molecules at the oil-water interface, which act in the opposite direction from the original molecules, thus overcoming their emulsion-stabilizing characteristics.
2. It adsorbs on the surface of particles, such as clay or sand, changing them so that they no

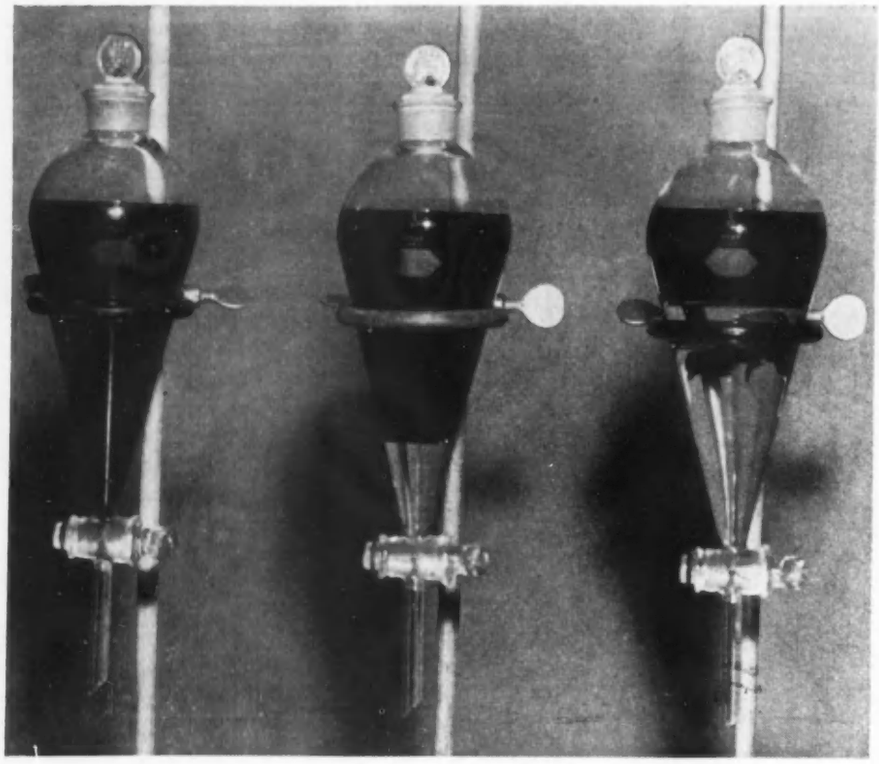


FIGURE 2—These three separatory funnels illustrate the effectiveness of a surface-active agent in breaking out a crude oil-brine emulsion. The first funnel contains the untreated emulsion. The second funnel shows the amount of break-out after one minute. The third funnel shows break-out after ten minutes.

longer tend to stay at oil-water interface.

While partial water blocks may often be undetected, especially in wells which are producing the maximum allowable, one may be indicated by a rapid decline after a period of good production. A complete water block may be present when there is a sharp loss of production following completion or workover operations, or when a well is dead after a shut-in period. In most cases, the low cost of treatment makes it more economical to treat a well suspected of having water block than to carry out a testing program to determine whether or not one is present.

The treating solution applied to wells usually consist of 1 percent concentration of the surface-active agent in kerosine or a light crude oil. This solution may be forced into the formation by means of a pump truck, or by gas or hydrostatic pressure. Usually about 2 barrels of the treating mixture is applied per foot of formation. Well shut-in time generally varies from 12 to 24 hours.

When a pump truck is used, the injection pressure should be kept well below the pressure required to fracture the formation. Best results are usually obtained by relatively slow injection rates, so that a soaking action is obtained.

The results of well treatments for water block are sometimes surprisingly dramatic. For example, a well in Kleberg County, Texas, was producing 80 bopd and trace water from the Frio formation. After the operator worked it over, the well was dead. A mixture of 20 gallons of surface-active agent in 2000 gallons of oil was injected. Following this treatment, the well came back and produced 79 bopd and trace water.

More typical of field experience is the case of a Young County, Texas, well producing from the Caddo lime. It had been fractured with an acid-oil fracturing fluid. During the clean-up following the treatment, a severe emulsion problem was encountered. The well was treated with 3000 gallons of high-gravity oil containing 30 gallons of surface-active agent. As a result, the emulsion difficulty was cleared up and the well showed a production increase of 30 bopd.

A well in Stonewall County, Texas, producing from the Canyon sand, was fractured, using a gelled-lease-oil fracturing fluid. Following the treatment, the well made several hundred barrels of emulsion. A treatment with the surface-active agent stopped the emulsion difficulty and resulted in a stabilized production increase of 22 bopd.

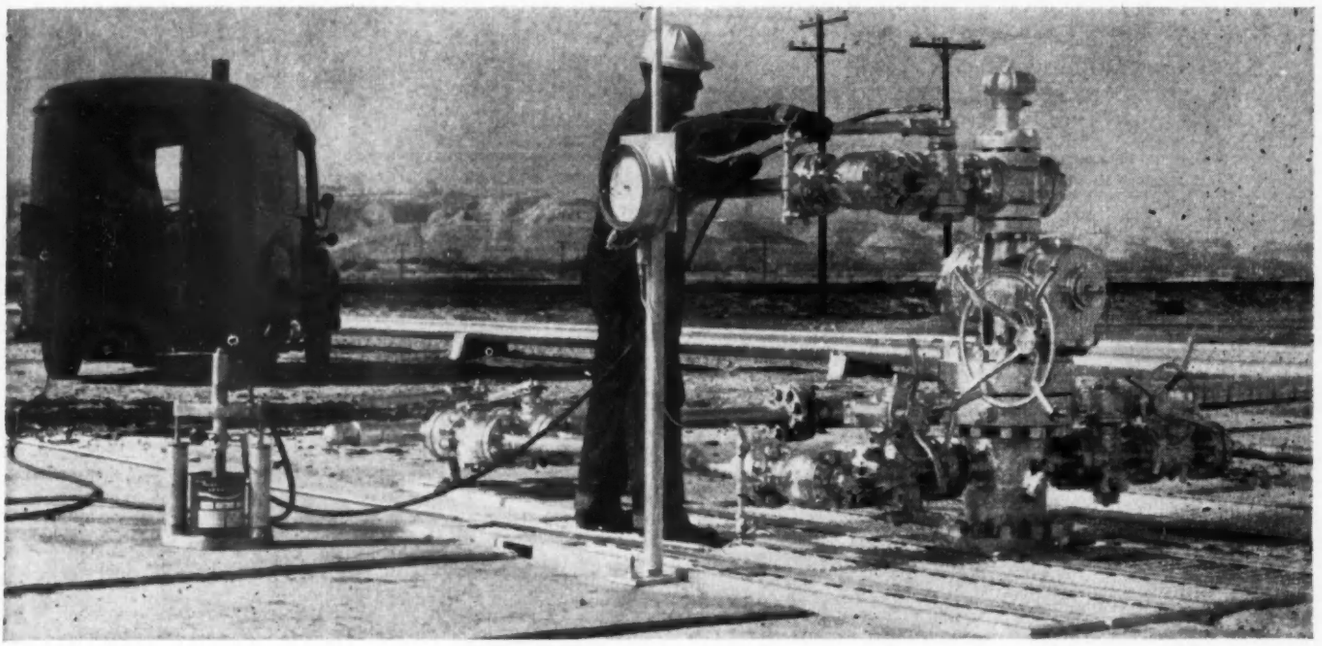
Typical application results on 12 wells are shown in Data Table 1. Consideration of these production results shows that in most cases, not only was total oil production increased, but the oil/water ratio was also improved. In only two cases did the surface-active agent fail to improve this ratio. —**The End**

TABLE 1

No. Well	Well Problem	Amount of Agent (Gal.)	Other Fluid Used	Production BOPD	Before BWPD	Production BOPD	After BWPD
1	Water block	40	4000 gal. oil	7	235	8	100
2	Water block	5	1000 gal. oil	12	2	44	3
3	Dead after workover	20	2000 gal. oil	0	0	79	Trace
4	Water block	10	1000 gal. oil	7	0	18	0
5	Water block	10	4410 gal hot oil	1	10	10	10
6	Water block	10	4410 gal. hot oil. 1 bbl. HCl	1	10	9	10
7	Water block	10	7350 gal. hot oil. 1 bbl. HCl	6	15	27	15
8	Water block	10	9450 gal. hot oil. 1 bbl. HCl	6	15	16	15
9	Water block	20	9450 gal. hot oil. 1 bbl. HCl	0	4	8	4
10	Water block	10	252 gal. oil	6	10	12	12
11	Water block	10	1000 gal. kerosine	41	83	68	137
12	Water block	10	1000 gal. kerosine	15	5	28	15

About the Author

P. B. (BUDDY) BURRIS received a B.A. degree in business from Oklahoma University in 1949. He joined Dowell Incorporated in 1952 after playing professional football and working with Western Acid and Perforating Company. He served Dowell first as a service engineer and is now a sales engineer at Oklahoma City.



A fully equipped valve servicing truck is used to service valves on remote lease. In addition to the air compressor, hose and lubricant, the truck contains all tools and spare parts normally required for on-the-spot maintenance.

Proper Maintenance Extends Valve Life

Here's an outline of a program that can be adjusted to the individual needs of any company.

By Paul A. Manor, Chief Engineer,
Central Valve Research
Rockwell Manufacturing Company, Pittsburgh, Penn.

IT IS HARD to overestimate the importance of periodic valve maintenance to the petroleum industry. A well-run maintenance program can add years to valve life and substantially reduce operating costs. In the case of lubricated plug valves, the maintenance program is often of particular importance, since this type of valve is frequently used where tight, leak-free operation is essential.

Maintenance procedures for lubricated plug valves vary widely among petroleum operations. One western company operates a special valve service truck, a self-contained maintenance department. Equipped with an air compressor, air hose, lubricant, tools and spare parts, the truck makes the rounds of the company's natural gasoline and compressor plants at intervals of from two weeks to six months, servicing over 15,000 valves.

At a large southwestern oil field installation the procedure is the same, but the truck is operated by the valve manufacturer on a contract basis. A large Eastern refinery prefers to localize valve servicing within areas; the crude still foreman or poly plant foreman supervises valve maintenance within his area, while the refinery maintenance crew takes care of any large-scale valve repair or reconditioning.

Each of these procedures is equally satisfactory. There is no one best way to set up a valve maintenance schedule, and each company can find the method that best fits its operation. The important thing is that valve maintenance be established on a regular basis.

The frequency with which lubricated plug valves should be serviced will vary with the frequency of valve operation, nature of the line fluid, temperature and other factors. Valves on a poly plant reactor are usually serviced daily, while infrequently-used valves on gas transmission lines may go six months or longer without lubrication.

The following list may be helpful as a general guide for regular lubrication:

1. Refineries, gasoline plants and compressor plants—once a week.

Check grooves to determine if they have been cut away during re-machining or need deepening.

A good grade of compound is applied for the lapping operation. Grit is suspended in an oil emulsion.

2. Gas, crude and products pipelines—once a month.

3. Oil well mud manifolds—each tour.

4. Valves infrequently used, as on gas distribution systems—every six months.

5. Valves on corrosive fluid lines—twice a week.

6. Valves operating many times daily at high temperatures.

Given the same regular maintenance as other oil industry equipment lubricated plug valves give years of effective service—many original installations are still in use after over 20 years on christmas trees, pipe lines, manifolds and distribution systems.

Repair Versus Replacement. In the case of valves which have seen long, hard usage, the question of repair versus replacement is sometimes hard to determine. A certain amount of repair is, economically justified. Often by merely cleaning or packing a valve it may be restored to useful service. More extensive repairs are also justified. But a point is eventually reached—depending upon the size of the valve and the time required for repair—when it is cheaper to replace than repair.

All lubricated plug valves are worth reclaiming if their condition is such as to require only cleaning, inspection, and reassembly with new packing and gaskets. A light re-lapping operation may be required to eliminate scaly deposits and superficial scoring or pitting.

Judgment must be exercised in cases where the valve body may require reboring and fitted and oversize plug, or building up of surfaces with weld metal. This type of work is not economically justified for low and medium pressure valves. As a general rule, complete rebuilding of a 4-inch and smaller 175# WOG or 2-inch and smaller 200, 400, 500 and 800# WOG semi-steel valves should not be undertaken. The final decision to repair or not will involve consideration also of available equipment, labor and overhead rates.

The repair procedures to be outlined here may be performed either in the field or in an outside repair shop.

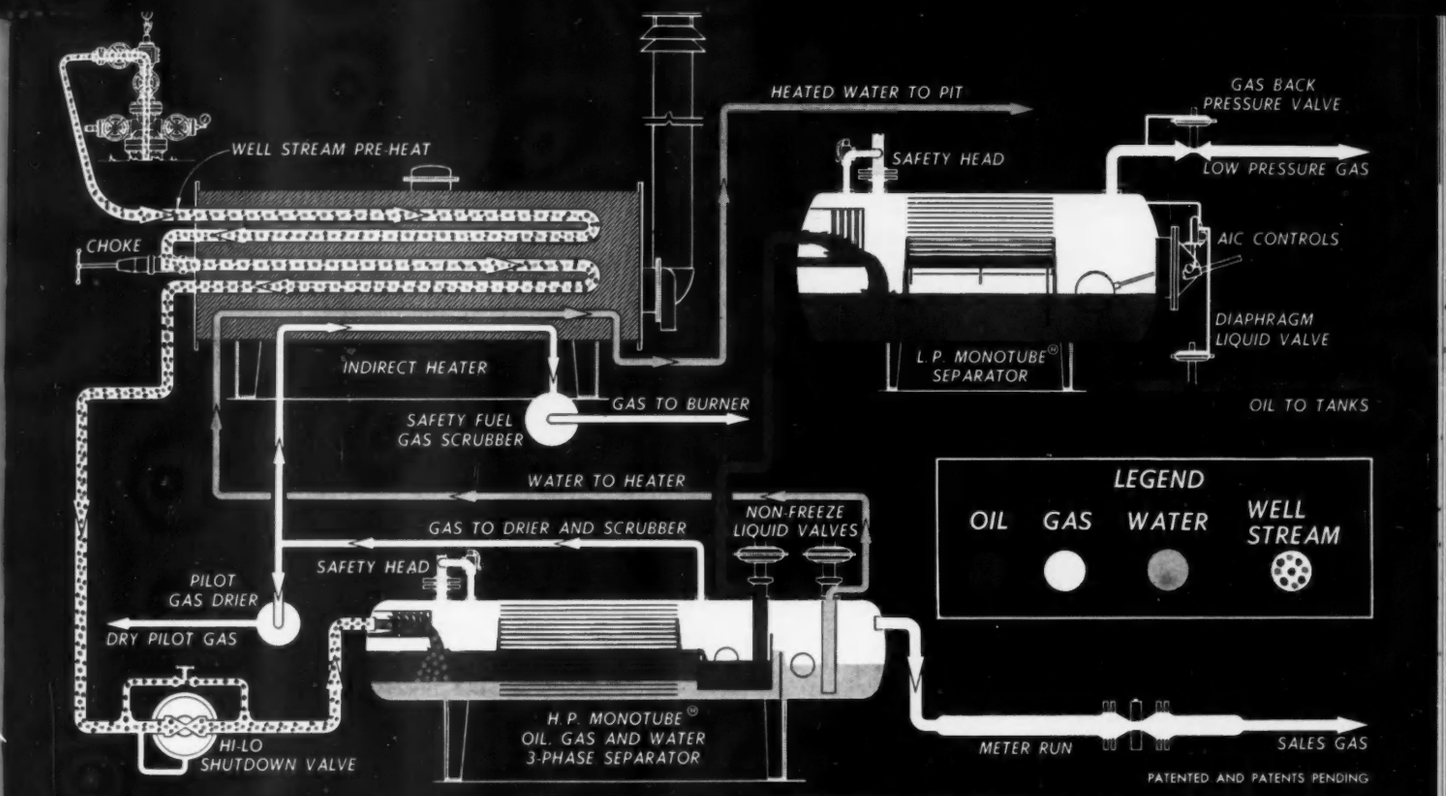
Cleaning and Examination. Valves which have seen long service may have an exterior coating of dirt, paint or other foreign matter. The valve should be cleaned before disassembly.

After complete disassembly of the valve, parts should be cleaned with any suitable alkaline or solvent solution. Wire brushing or abrasive blasting may be required to remove deposits from corroded areas. Tapered seats of both body and plug should be carefully examined for corrosion, pitting, scoring, galling or erosion. For plugs with integral shanks, the machined shank diameter and the adjacent shoulder on the plug should be similarly examined.

The extent and depth of blemishes in seating surfaces of both plug and body will determine the repair procedures necessary to restore the valve to good operating condition. Here are some typical cases:

Case 1: Corrosion or scoring is quite shallow. Here the valve may be returned to service by relapping the plug in the body without machining seating surfaces. In the case of integral-shank plugs, however, the shank diameter and adjacent shoulder must be resurfaced by turning or grinding before relapping.

Case 2: Corrosion, galling or scoring of moderate depth. It will be necessary to remachine the tapered seating surface of the body. This operation usually requires an oversized plug



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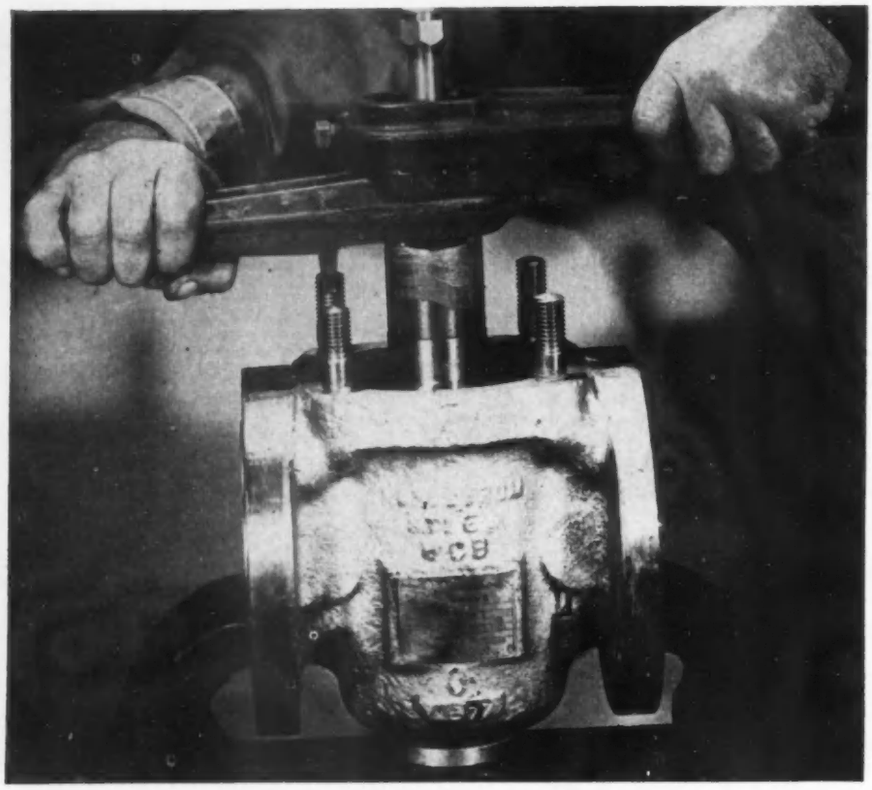

Final lapping can be done by hand. Plug is oscillated four or five times between each lifting of plug from body.

to match the oversizing of the taper bore.

Case 3: Severe corrosion, galling and deep scoring. In order to restore the tapered seating surface, it will be necessary to rebuild the worn areas in the body before machining the valve body bore. Rebuilding can be done by an approved welding or grazing process on steel bodies only. This process is not recommended.

Valve plugs are individually fitted and lapped to the bodies by the manufacturer. Replacement plugs are furnished oversize with a semi-finished taper to allow metal stock for fitting to re-bored bodies. Most valve bodies are designed with ⅛" extra metal thickness at the tapered section to permit one or more re-boring operations without reducing wall thickness below allowable limits. Replacement plugs are generally furnished to standard oversize taper dimensions. Plugs with greater oversize can, under exceptional conditions, be obtained on special order from the manufacturer.

Re-Machining Valve Bodies and Plugs. An accurate lathe with taper attachments set 4½ degrees from centerline should be used for re-machining bodies and plugs. In some cases, the body casting need only be set true to the original bore; in others it must also be aligned with the threatened plug stem hole. Eccentricity of the stem hole with the taper bore in the body should not exceed 0.005 inch; otherwise a binding action will result between the plug stem, equalizer ring and the tang on the plug after the valve is assembled.

A trial cut should be taken to check correctness of set-up and taper angle. Sufficient cuts should be taken to remove all blemishes, and the final cut should produce a smooth, straight, round bore. After the bore is machined, the lubricant grooves or ducts on the body should be checked. If any are missing or greatly reduced in depth, they should be reproduced either by chipping, machining, or grinding; they should be located in the same position as in the original bore.

Before machining the plug, the taper should first be machined to caliper-and-scale dimensions taken from the valve body. Sufficient metal should be allowed for final matching of taper and diameter. After the plug is turned down to the point where it will enter well into the body seat—but not all the way—the taper should be checked very closely with strips of "feeler stock" placed between the plug and the body near both ends of the taper. It may be necessary to repeat this procedure, taking light trial cuts and adjusting the lathe taper attachment each time, until an exact fit is obtained.

After the taper is exactly matched, further light cuts are taken until the plug enters the body with the plug shoulder *below* the body gasket seat a distance about equal to the minimum dimension allowed by the manufacturer. This will allow for a slight further drop of the plug in the final lapping operation, without exceeding the manufacturer's maximum dimensions.

Lapping. If preliminary machine work has been done properly, it should be necessary to do only enough lapping to take out tool and grinding marks and produce a smooth finish on the taper surface.

Before the lapping operation is started, all sharp edges of both body and plug should be de-burred with either a file or emery cloth, and bearing surfaces should be cleaned and free of any dirt or metal particles. Valves may be lapped by hand or with an upright drill press. If a press is used, the valve body should be secured to either the table or the base and the plug rotated through a floating attachment connected to the spindle. Sufficient "float" must be provided to prevent the plug from lapping out of round in the body.

The lapping compound may consist of a 220-grit Aluminum oxide for steel, or a 200-grit silicon carbide for iron valves. The grit is suspended in a non-lubricating oil emulsion. Sufficient space should be provided between the plug and body to permit the lapping compound to spread evenly and produce uniform action.

Lapping is continued until all machining marks disappear and the surface shows a uniform finish. Rotation of the plug in the body should now show an even metal-to-metal contact, without excessive bright or dark areas. The accuracy of the fit can be checked by blueing the plug into the body and rotating it ¼ turn under light pressure. Any mismatching, off-taper cut or out of roundness will show clearly when the plug is removed and examined.

After lapping is completed, the depth of the plug in the body should be checked against manufacturer's specification. —**The End**

For Your PRODUCTION File

Part 3 in a series on reservoir engineering

Determining the . . .

Oil-Water Contact from Production Data

Production data can be used to calculate the oil-water contact if water coning into the oil zone and a transition zone are absent.

By Frank W. Cole
Assistant Professor Petroleum Engineering
School of Petroleum Engineering, University of Oklahoma, Norman, Okla.

IN A PREVIOUS installment, the oil-water contact in an oil reservoir was defined as the lowest structural position in the reservoir from which 100 percent oil can be produced. There are many cases where it is desirable to know the change in oil-water contact after the reservoir has been produced for some time. One method of determining the rise of the oil-water contact is by use of the well-known Darcy flow equation in conjunction with the production data. Using the radial form of the Darcy equation, the oil flowing through a reservoir can be expressed as follows:

$$Q_{or} = \frac{2\pi K_o h_o (P_e - P_w)}{\mu_o \ln r_e/r_w} \qquad (1)$$

To convert the oil flowing in the reservoir to that measured at the surface, it is necessary to correct for shrinkage of the oil as follows:

$$Q_{os} = \frac{2\pi K_o h_o (P_e - P_w)}{\beta \mu_o \ln r_e/r_w} \qquad (2)$$

The rate of water flowing in the reservoir is:

$$Q_w = \frac{2\pi K_w h_w (P_e - P_w)}{\mu_w \ln r_e/r_w} \qquad (3)$$

Combining Equations 2 and 3:

$$\frac{Q_{os}}{Q_w} \quad \frac{\dfrac{2\pi K_o h_o (P_e - P_w)}{\beta \mu_o \ln r_e/r_w}}{\dfrac{2\pi K_w h_w (P_e - P_w)}{\mu_w \ln r_e/r_w}} = \frac{K_o \mu_w h_o}{K_w \mu_o h_w \beta} \qquad (4)$$

or

$$\frac{h_o}{h_w} = \frac{Q_{os}}{Q_w} \frac{\mu_o}{\mu_w} \frac{K_w}{K_o} \beta \qquad (5)$$

also

$$h_T = h_o + h_w \qquad (6)$$

If mobility characteristics of the fluids, i.e., K_o/μ_o and K_W/μ_w are available, and the oil shrinkage is known, then the exact position of the oil-water contact can be determined using Equations 5 and 6.

In the development of this method, the assumptions are made that:

- Water coning into the oil zone does not occur.
- There is no transition zone where both water and oil are flowing.

NOMENCLATURE

Q_{or} = reservoir oil flow rate
Q_{os} = surface oil flow rate
Q_w = water flow rate
K_o = effective permeability to oil
K_w = effective permeability to water
μ_o = reservoir oil viscosity
μ_w = reservoir water viscosity
h_o = thickness of original oil reservoir flowing oil
h_w = thickness of original oil reservoir flowing water
h_T = total thickness of original oil reservoir
P_e = reservoir pressure
P_w = flowing sand face pressure
r_e = radius of drainage
r_w = radius of well bore
β = formation volume factor of oil

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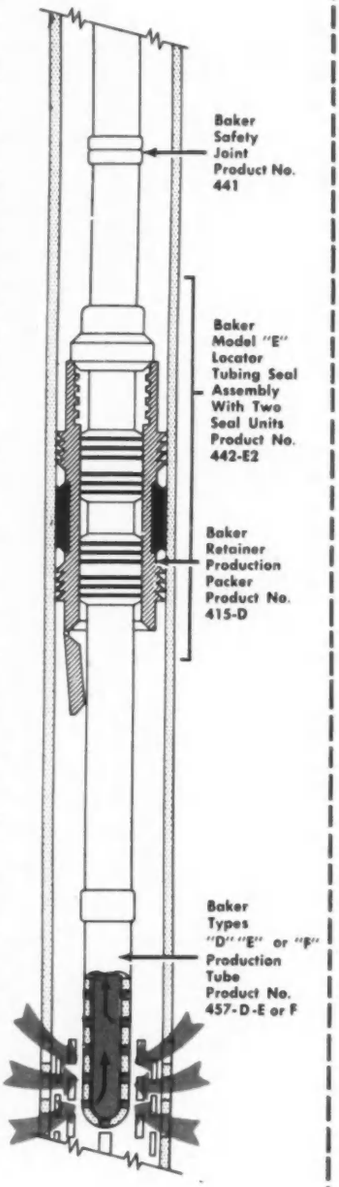
Baker Safety Joint Product No. 441
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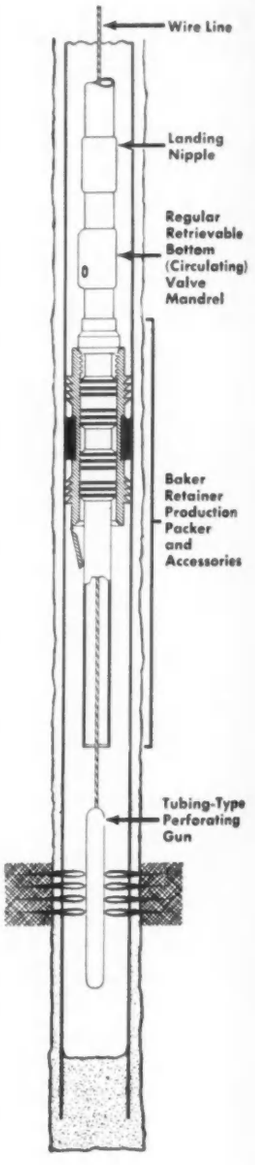
Illustrates Packer set in casing with Locator Tubing Seal Assembly and Production Tube installed for single-zone production.



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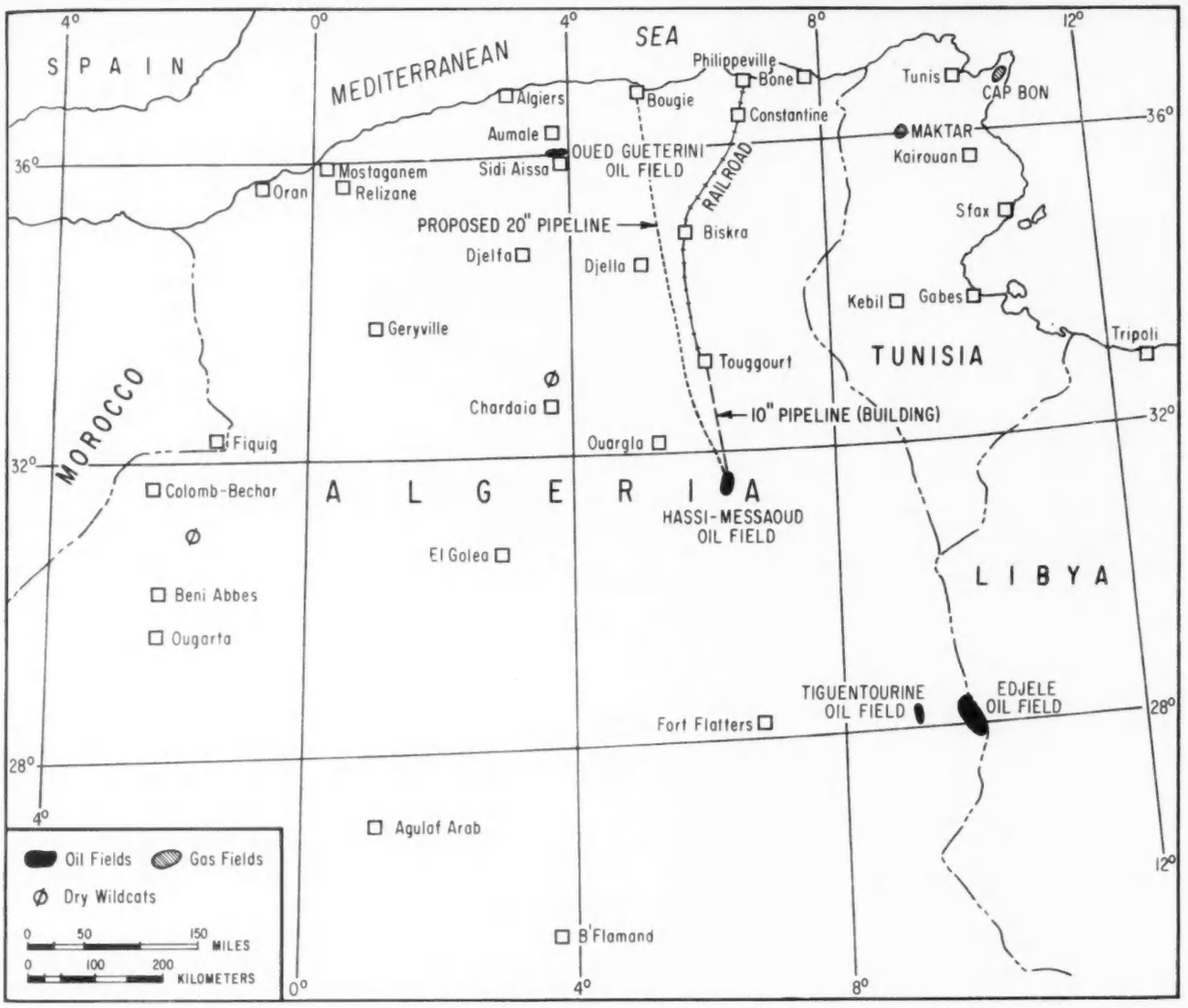

Algeria's Hassi-Messaoud oil field was given a limited market outlet in early 1958. A 10-inch pipe line has been built from the field to Touggourt, to connect with a railroad leading northward to Philippeville on the Mediterranean. Greater outlet for Hassi-Messaoud crude is planned. Pipe has been ordered for a 20-inch line from the field to the Mediterranean port of Bougie. Plans for the future also call for a large diameter pipe line from the Edjele oil field to a seaport at Tunis, Gabes or Tripoli.

Sahara Oil Begins Moving to Market by Pipe Line

Ten inch pipe line completed from Algeria's Hassi-Messaoud field to Touggourt. Crude will be shipped from there by rail to Philippeville on the Mediterranean.

Plans for future call for large diameter pipe lines from Hassi-Messaoud and Edjele fields to seaports.

By Grace Halsell

In spite of the continual rise and fall of French governments, work seems somehow to progress on the plan for building pipe lines to get the Sahara oil riches to Mediterranean ports.

A ten-inch pipe line recently was completed from the Hassi-Messaoud field a distance of 130 miles to Touggourt, to connect with a railroad for transport of oil 350 miles farter north to Philippeville on the sea. Filling of

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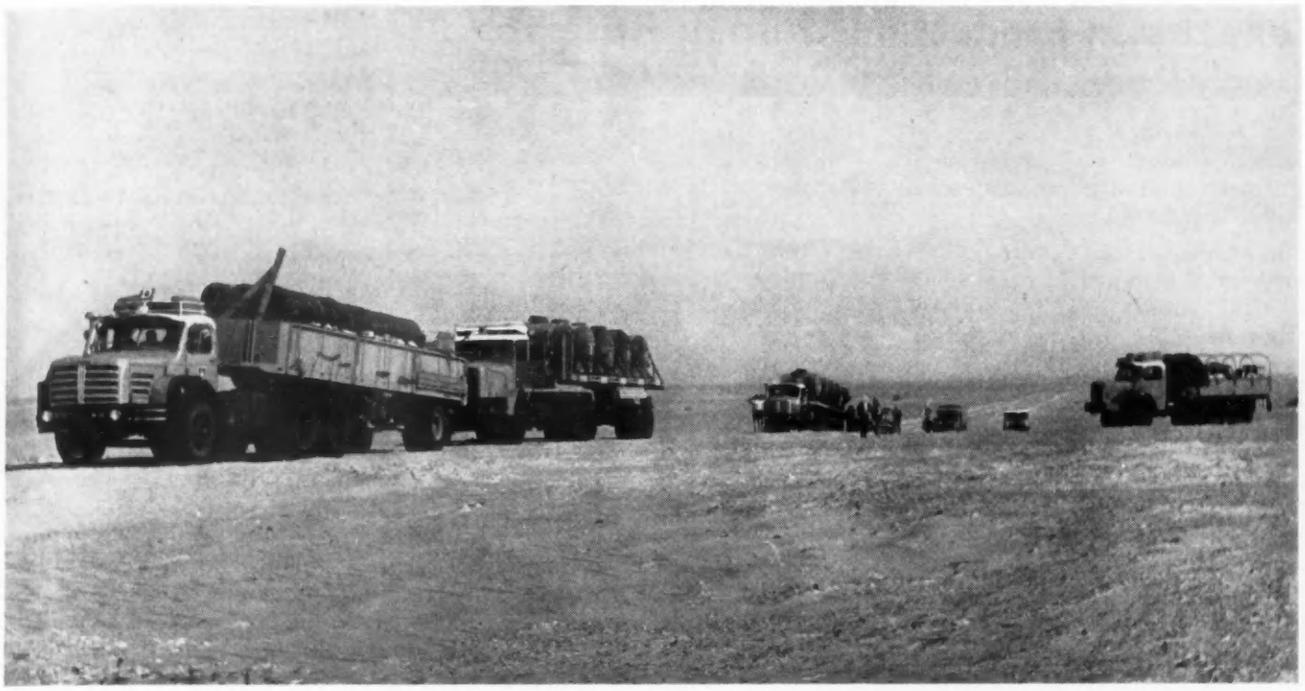

Algiers—Toggourt—Hassi-Messaoud—Edjele

A 300 horsepower truck leads a convoy on desert road to Edjele oil field in the Algerian Sahara, near Libyan border.

the line was in progress in early January, 1958.

Meanwhile, contracts have been given French firms for building 20-inch pipe, which eventually will be transported to the Sahara. One of the main lines will run a distance of about 600 miles from the Hassi-Messaoud field to the port of Bougie. "The cost of this line is estimated at 50 billion francs," ($100 million), J. Pavard, Paris, in charge of the Sahara mission, said. He added that construction probably could not begin for a year.

Estimated capacity of the Hassi-Messaoud field, opened with a wildcat by the Societe Nationale de Recherches et D'Exploitation des Petroles en Algerie (SN Repal), is 300 million tons per year (more than 60,000 barrels per day). This is 15 times France's yearly petrol consumption. The oil is found at average depths of 12,000 feet. It is light and sweet.

At the same time work begins on a pipe line to carry the Hassi-Messaoud oil to the sea, construction also is expected to begin on a line from the Edjele field (located in Algeria near the Libyan border) to a port either at Tunis, Gabes, or Tripoli.

The building of this line will be easier from a technical aspect, as the line to Bougie must push through two ranges of the Atlas Mountains, which harbor wild rebel bands, while the second line must await approval from either (or both) the Tunisian and Libyan governments.

"Talks have begun with these governments," M. Pavard said. He emphasized they were not "official" talks as yet, but merely preliminary talks, largely made so far by representatives of CREPS (Compagnie de Recherches et Exploitation de Petrole Au Sahara) which brought in the discovery well at Edjele. Probable reserve of this field is estimated at 700 million barrels.

While "preliminary talks" are going on concerning the construction of this line, the American firm, Bechtel, has had top officials in Paris conferring with CREPS on the cost and technical aspects of building the line.

In his October visit to the Sahara, M. Pavard flew 5000 miles in a DC-3, landing at a number of oil and gas fields. The Sahara, which includes parts of Sudan, Niger and Chad (but not any of Mauretania as yet) "is eight times the size of France, but has less than 1,000,000 population," M. Pavard said. The people, which include Arabs, Berbers and Sudanese, have a diversity of languages and customs. Largely they are Nomads.

About 3000 workmen now are in the Sahara fields. Thirty-four drilling rigs are now in use, and 55 will be needed in 1958, when it is estimated the French will have invested 74 billion francs in research, development and transport facilities for Sahara oil. (This represents more than $150 million.)

French officials all emphasize the exploration and production of the Sahara riches cannot be a "selfish enterprise," and Western nations have been invited to take part in the discoveries and production. M. Pavard said 11 groups have made inquiries about Sahara oil operations, and that American companies expressing interest include Cities Service, Sinclair, Newmont and Phillips Petroleum.

In addition to the oil, the Sahara has gas wells at Djebel Berga (near In Salah) and at Tilrhemt (below Laghouat). "We hope to have a gas line running to Algiers within two or three years," M. Pavard said. Gas plants will be constructed in Algiers. French engineers have been studying the methods of transporting high pressure gas by ship now in use on the Mississippi River in the U. S.

—The End

Venezuelan Production Output, Reserves Reach Record-Breaking Peak in 1957

For Venezuela, 1957 averaged out to another record-breaking year in both production of oil and extension of proved reserves.

In the first half of the year, production went as high at 2.97 million barrels daily, and it now appears that output for 1957 will average about 2.8 million barrels per day. This represents an increase of about 13.5 percent over 1956, although production at the end of the year was down to about 2.5 million. Estimates indicate that at year's end the nation's proved reserves were well in excess of 14 billion barrels.

A remarkable development of the Venezuelan economy as a whole was sparked by a second round of new oil concessions, for which the national treasury received initial payments of $370 million. In the first round of concessions, granted in 1956, initial payments totaled $316 million.

The decline in production during the last half of the year was due in the first instance to the resumption of the normal flow of oil from the Middle East. During the Suez crisis, Venezuelan production increased by some 400,000 barrels daily. This temporary gain has now been erased.

Venezuela has also been affected by voluntary reduction of imports of crude oil into the U. S. requested by President Eisenhower. Prior to application of the voluntary reduction program to District 5, it was estimated that this program was costing Venezuela some 135,000 barrels daily in market outlets. While Venezuela has not been a major source of West Coast imports in the past, several of the new producers in Venezuela expected to find outlets for their oil in District 5. The inclusion of this region in the voluntary reduction program will, therefore, tend to limit the growth of Venezuelan exports to that area.

A third factor contributing to the decline in market demand was the general economic slow-down in many parts of the free world.

Considerable concern is now felt in Venezuela regarding the possibility of future restrictions of U. S. petroleum imports, which might well impair the health of the Venezuelan oil industry. Approximately 65 percent of the industry's production is accounted for by U. S. firms.

Through sale of its oil, Venezuela has been able to earn dollars that make it one of the richest markets in the world for U. S. exporters. In 1957 Venezuela's purchase of goods and services from the U. S. exceeded $1 billion.

More attention should be paid to the importance of Venezuelan oil in the security picture of the U. S., the western hemisphere and the free world, assert spokesmen for some U. S. oil companies operating in Venezuela. They declare that any further restrictive measures which would further curtail Venezuelan production might well have a serious effect upon the ability of Venezuela to produce the oil that would be needed to deal with any future emergency.

As 1957 drew to a close, it was increasingly evident that a substantial excess of oil producing capacity exists in all major producing areas. The only cure for this situation, say oil executives, is for major producing countries to exercise patience and restraint until demand again regains a reasonable balance with supply.

Saudi Arabian Production Less in 1957 Than in '56

Crude oil production in Saudi Arabia during November totaled 30,414,774 barrels, or an average of 1,013,826 barrels per calendar day, the Arabian American Oil Company announced. This compares with 21,592,614 barrels, or an average of 719,754 barrels per calendar day, during the same month last year.

Crude processed at Aramco's Ras Tanura refinery during November amounted to 5,205,630 barrels, an average of 173,521 barrels per calendar day, as compared with 4,398,105 barrels, an average of 146,604 barrels per calendar day, during the same month last year.

Aramco's total production of crude oil during the first 11 months of 1957 was 329,470,630 barrels, an average of 986,439 barrels per calendar day. This compares with a total of 339,523,089 barrels, an average of 1,013,502 barrels per calendar day, during the same period last year.

Crude run in the refinery during the first 11 months of 1957 amounted to 65,011,160 barrels, an average of 194,644 barrels per calendar day, as compared with 66,688,142 barrels, an average of 199,069 barrels per calendar day, during the same period last year.

Oil Leases in Interior of Sarawak Surrendered

Sarawak Oilfields Ltd., a member of the Royal Dutch/Shell Group of companies, at end of 1957 surrendered 36,650 square miles of oil leases in Sarawak, mainly in the interior. Intensive prewar and postwar surveys had produced no evidence of oil. The company had drilled 17 deep exploratory wells, some in remote localities. But all were dry with the exception of those at Suai, near the coast, where insignificant quantities of oil and gas were found.

The company will retain under the concession 10,850 square miles, mainly in the coastal region, where the search for oil will continue.

Search is also being directed towards the extensive unexplored areas beneath the sea. Between 1954 and 1956 the company participated in a co-ordinated survey of the offshore areas of Sarawak, Brunei and North Borneo. The results of this marine exploration have been sufficiently promising to warrant drilling at several locations in Sarawak waters. The first two wells have been drilled by Sarawak Oilfields Limited from a marine platform at Siwa, some eight miles offshore, and Brunei Shell has drilled one well from a similar platform at Ampa Patches, about 25 miles offshore. Although these wells were dry, the intention is to continue with further exploratory drilling at sea. A mobile platform, now on order, is to be hired for this purpose.

Trans-Arabian Pipe Line Runs Show Gain in 1957

Trans-Arabian Pipe Line Company delivered 125,331,297 barrels of crude oil during 1957 for an average of 343,373 barrels per calendar day. The boost in the average daily rate was 12,628 barrels, or 3.8 percent higher than the 330,745 barrels per calendar

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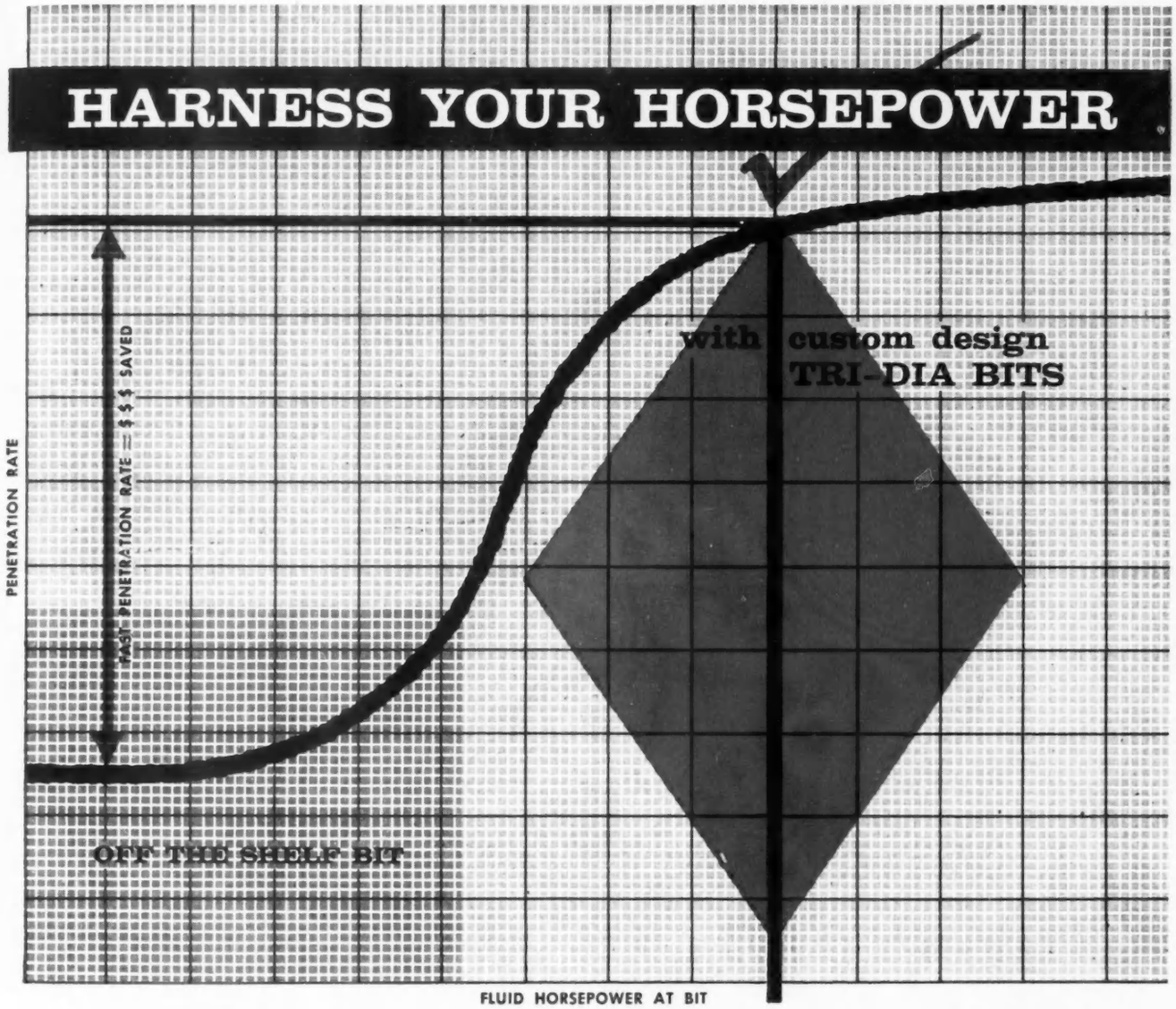

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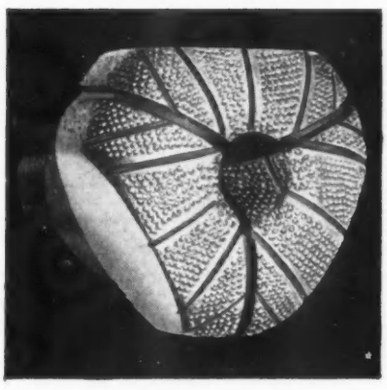

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BOTTOM DISCHARGE VALVES

It has long been known that a bottom discharge valve would keep the area between the pump and tubing free of sand by discharging a portion of the produced fluid at the hold-down. As long as the upward velocity of the fluid exceeds the settling rate of the sand, the annulus remains clean.

Prior to the introduction of the Oilmaster Model 63, bottom discharge valves have not been as dependable as the other components of the pump. Still, they were in common use by operators who preferred to pull a pump prematurely if necessary, rather than risk pulling a tubing string wet.

Wet jobs are caused by a pump that is stuck so tightly in the tubing string that it cannot be unseated with the sucker rods. The sticking is most commonly caused by sand settling around the pump barrel above the hold-down. The worst hazard occurs in a stationary barrel bottom anchor pump, where the sand can fill in all the way to the top of the pump.

The Model 63 represents an entirely new approach to the pump valve design problem, and has overcome the weaknesses that previously existed. Numerous improvements have been made that can best be appreciated by a demonstration. Call your Oilmaster representative and ask him to bring out a Model 63 on his next call, or better, ask him to insure you against wet jobs by having him install them on all your stationary barrel bottom anchor or Multiple Tube Fluid Packed Pumps. Try them on long stroke pumps too, to eliminate the need of a top seal element.

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oilmaster PUMPS FOREMOST IN THE INDUSTRY

day delivered in 1956 for a total that year of 121,052,745 barrels.

During December, 1957, Tapline delivered from the Sidon, Lebanon, terminal 10,093,567 barrels for a daily average of 337,166 barrels. Tapline's December, 1957, deliveries represent a 3 percent decrease from the December, 1956, figures, when 10,765,606 barrels was reported for an average of 347,278 barrels per day.

New Oil Field Reported Discovered in Moldovia

New oil deposits have been found in Moldovia S.S.R. Kishinov, in the southwest corner of this part of the Russian S.S.R., is the center of the newly located oil deposits. Strata vary between 1150 and 1650 feet in depth. The geological structure there is claimed to match that of Ploesti, Rumania. The deposits are claimed to be large enough to fulfill that state's full requirements.

The areas of Ploesti and of Kishinov are separated by an underground, so-called Dobrudge swell.

There are reasons to believe that the Moldovian oil fields are part of an enormous oil belt stretching from the Eastern foothills of the Alps (Austria) to Maykop and Grozny in the Northern Caucasus, and further across the Caspian Sea into Turkmenia to the Western foothills of the Pamir and the Altai mountains.

Drilling and Exploration Co. of Dallas Acquires Six Bolivian Concessions

Drilling and Exploration Company, Inc., Dallas, is extending its activities into Bolivia. In December, six concessions comprising a total of 500,000 hectares (1,250,000 acres), by executive decree were granted to Bolivian Petroleum Corporation, a wholly owned subsidiary.

These concessions are in an area of eastern Bolivia considered favorable for development of oil or gas. Major companies holding concessions in the same area include Bolivian Gulf Oil Company, Shell Prospecting Company, Andes Oil Company, Inc. (Pure et al), and Chaco Petroleum, the last named having been organized jointly by Tennessee Gas Transmission, Union Oil & Gas of Louisiana, Lion Oil, and Murphy Corporation, for the purpose of acquiring properties formerly operated by the Glenn H. McCarthy interests.

Extensive geological and geophysical studies have been carried on by various companies, including the Government Agency, Y. P. F. B., in this wide belt along the east flank of the Andes Mountains in eastern Bolivia, extending for more than 300 miles northward from the Argentine border.

More than 100 structures have been mapped. Testing of 33 of these, by no means adequate or conclusive, has resulted in the discovery of 11 oil fields, four of which are being actively operated by Y. P. F. B. Production therefrom of about 10,000 barrels per day is restricted by local demand and limited exports of crude and products to neighboring countries, which constitute the only present market.

It is reported that one or more of the American companies holding concessions in this area of Bolivia, having completed preliminary geological investigations, plan to initiate exploratory drilling in the immediate future.

Tidewater et al Drilling In Southeastern Turkey

Drilling operations have begun in southeastern Turkey at the first exploratory well undertaken by a group consisting of Atlantic Refining Company, Seaboard Oil Company and Tidewater Oil Company, with the latter serving as operator.

Located in the Mt. Bakuk area, approximately 15 miles northeast of Nusaybin, the wildcat well is scheduled to test the Cretaceous section, productive in Iraq to the south.

The three companies jointly hold more than 3,000,000 acres in exploration licenses in Turkey.

Gulf Oil and Feldman Will Explore Jointly in Turkey

An agreement concerning oil exploration in Turkey was concluded in early January, 1958, between D. D. Feldman Oil and Gas Inc. of Dallas and Turkish Gulf Oil Company, a newly formed wholly-owned subsidiary of Gulf Oil Corporation of Pittsburgh, Penn. The agreement had been made with the approval of the Turkish Petroleum Administration.

Feldman has assigned to Gulf an undivided 75 percent interest in 13 oil and gas licenses, covering approximately 1½ million acres in several parts of Turkey.

Turkish Gulf Oil Company has been incorporated to continue the exploration work undertaken by Feldman, Turkish Gulf becoming the operator on behalf of the two companies.

The agreement between Gulf and Feldman in no way affects other operations conducted by the two companies and their affiliates in Europe, North Africa and the Middle East, where both are currently engaged in active oil and gas exploration work.

Sound Waves Remove Oil From Sands in Alberta

A new answer to the old problem of removing the oil from Alberta's oil sands has been found. Experiments are now being conducted in attempts to design equipment to make large scale operation feasible.

The new approach to the separation process is based on the use of high frequency sound waves. The man who discovered the process is J. P. J. Fitzgerald, managing director of Sonic Oil Company.

In tests, sound waves were shot out through loud speakers immersed in the sand. This brings about immediate particle size reduction and complete separation of the oil, sands and other liquids.

The Alberta Research Council has been kept informed of progress of experiments.

Royalite Oil Company is currently engaged in a program in the oil sands areas, using the Coulson separating process based on the use of centrifugal force.

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2. **Gasoline Plants — For The Chilling Of Absorption Oil To Increase Hydrocarbon Recoveries Without Installing Larger Absorption Oil Towers Or Pumps.**
3. **Lease Production — To Provide Essential Refrigeration For Maximum Hydrocarbon Recovery Where Sufficient Pressure Expansion Is Not Available. Also To Supplement Declining "Natural" Refrigeration.**

These Ammonia Absorption Refrigeration Units are built for rugged, heavy duty, 365 day-per-year continuous operation, and are available in eleven standard sizes. Completely automatic in operation, they are equipped with BS&B oilfield-type controls and motor valves which are already familiar to oilfield operating personnel.

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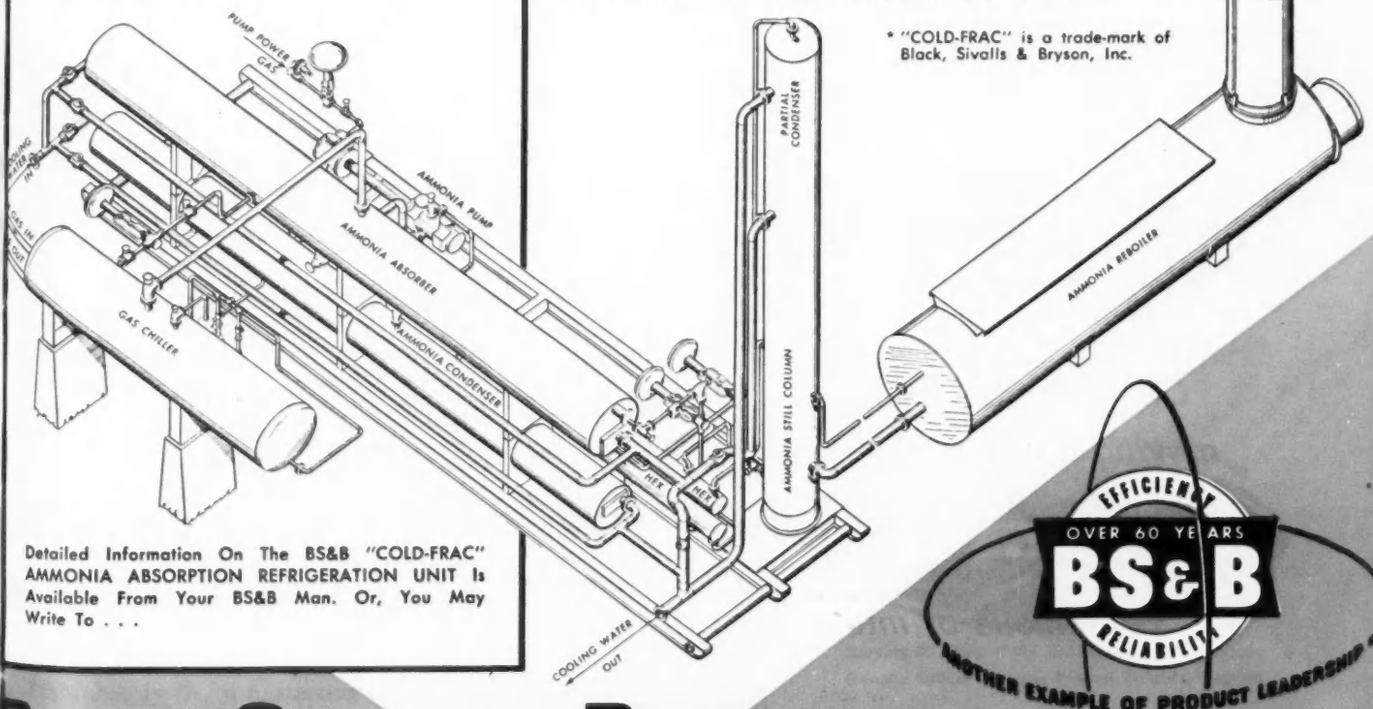

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Bolivian Crude Oil Output Up About 11.3% in 1957

Crude oil production in Bolivia averaged 9754 barrels per day during the first 11 months of 1957, according to Yacimientos Petroliferos Fiscales Bolivianos (YPFB). Total production through the end of November in 1957 was 3,257,682 barrels. Assuming that total December production would be confirmed at 300,000 barrels or more, it appeared that total 1957 crude production would reach a minimum figure of 3,557,682 barrels, representing at least a 11.3 percent increase as compared with the 1956 total of 3,195,819 barrels (8731 barrels daily).

Both crude oil production and drilling rates were expected to increase very moderately during the first ten months of 1958, because YPFB's production is reaching the limit of its pipe line capacity to move crude to refineries and markets. If additional pipe line outlets are completed on schedule by the end of October, 1958, crude production could be increased abruptly by as much as 40 percent shortly thereafter. Ten wells capable of producing oil were capped as of the end of November, including seven in Camiri field, two at Sanandita, and one at Bermejo.

MONTH	Total Crude Oil Production (Barrels)	Number of Wells Completed During Month
January	294,303	1
February	276,839	1
March	304,611	1
April	286,920	3
May	295,397	3
June	286,552	1
July	287,670	2
August	309,269	3
September	311,654	1
October	299,546	1
November	304,921	2
Totals, first 11 months, 1957	3,257,682	19

YPFB had a total of 12 rigs in Bolivia as of November 30, and 11 of them were actually engaged in drilling wells at that time.

Crude oil production in Bolivia by months in 1957, together with the number of wells completed at the same time, are as shown in a table herewith. Drilling continued at about the same rate in 1957 as in 1956, when 25 wells were completed during the full 12-month period.

Offshore Oil Is Object Of Drilling in Bulgaria

Search work has revealed offshore oil in Bulgaria. The major Bulgarian field, located at Tuljanovo, on the shore of the Black Sea, has been further tested by geophysical crews. The result: oil deposits are certain to exist just offshore.

The Varna Oil Gear Shop has assembled the first Bulgarian directed-drilling rig, and the first transversal directions well is now under way. Two more wells are to be drilled. Well No. 1 has reached a depth of 1475 feet, the distance of the drill bit being more than 650 feet off shore.

Bulgaria expects all-time high crude oil production in 1958. The country hopes to reach a crude output of 280,000 metric tons (about 2.1 million barrels, or 5750 barrels daily average) this year—just three years after organized oil drilling started. Bulgaria so far has received only half-hearted Soviet aid in developing domestic oil output.

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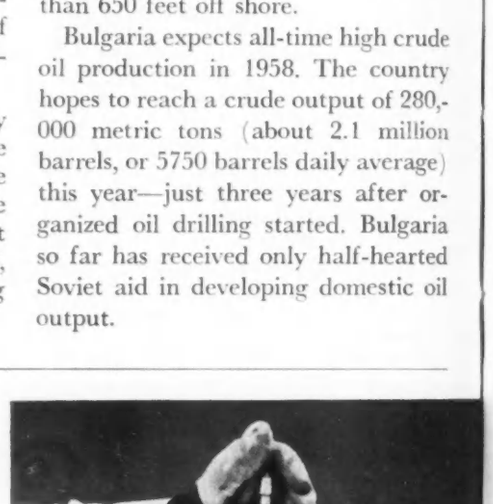

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MenHall and Associates Continue Syrian Drilling

J. W. MenHall continues drilling in the Karatchok area of northeastern Syria, with three rigs in operation as of January, 1958. Portsmouth Steel Corporation and Atlantic Refining Company also have interests in this venture. Oil was discovered on the Karatchok structure in 1956, when about 90 feet of pay was found in fractured Cretaceous limestone between 6500 and 6780 feet, in Karatchok 1.

MenHall et al are operating two National 100 rigs leased from the Syrian government, and also have two smaller rigs rated to about 5000 feet. Karatchok 2, located about 1½ miles west of the discovery, was completed late in 1957. Productivity of the two wells is estimated at from 1000 to 2000 barrels daily each.

The Karatchok structure as so far defined runs approximately east-west. A shallow test, located 1½ miles east of Karatchok 1, had been drilled to 4500 feet but was expected to be deepened later. Two additional tests, being 1½-mile westerly stepouts from Karatchok 2, were being drilled in January, 1958.

MenHall expected to complete the two drilling and one suspended tests during 1958. If current negotiations with the Syrian government regarding exploitation rights and production are resolved satisfactorily, drilling will be continued beyond the scope of the current tests. Otherwise, development will be suspended. There was no commercial crude oil production from the Karatchok field in 1957.

Demand for Alberta Crude Oil Is Higher in January

The lagging demand for Alberta crude oil, which has been evident during the past several months, has been promised a slight upturn for January.

Refiners using Alberta crude have nominated for 344,527 barrels daily during the month, an increase of 45,605 barrels daily over December demand.

The improved outlook is credited to the fact that refinery turn-arounds are nearly completed and most companies, with inventories decreased to favorable levels, are starting to increase stocks of refined products.

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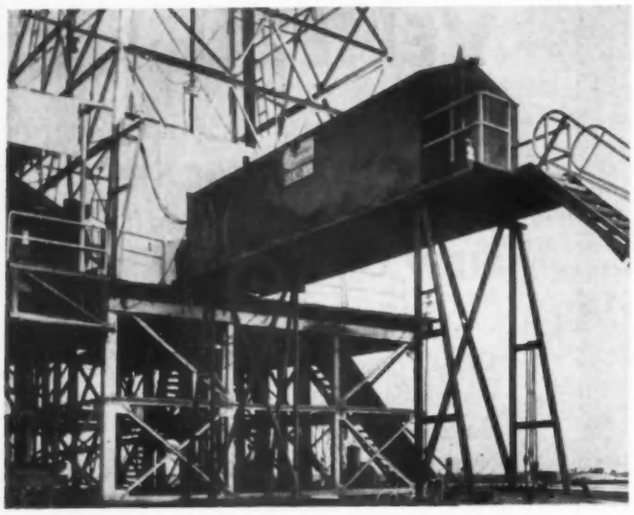
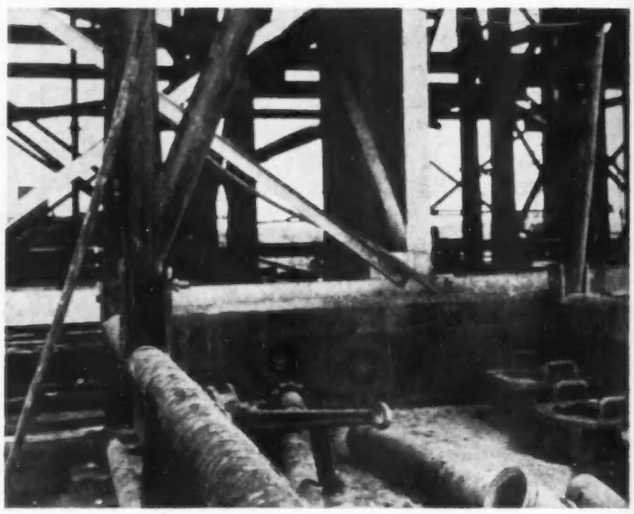




Doghouse and Junk Bin Are Unitized for Single Load Moving

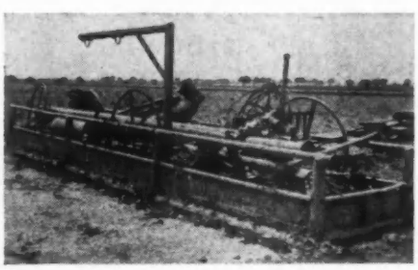
If a rig has a high substructure and the doghouse is at floor level, the junk bin and doghouse can be unitized to make moving easier. The photograph shows how one contractor combined the two and used the junk bin as a stable base for the doghouse when it is sitting so high from the ground.

The construction of the doghouse support frames are of welded pipe. The base of the doghouse rests on the top of the folded support and the junk bin when the unit is in transport. The unit is made ready for transport by removing the doghouse from the supports and folding the supports down. To fold the supports, the pins at each of the outer four corners of the bin are removed.

One support is lowered until its side is resting on the junk bin. The other support is then lowered until its side is resting on the slant of the first support. The supports are constructed so that they will form a flat surface for the doghouse to ride on while the unit is in transit. When rigging-up, the doghouse is removed, the supports are raised and pins placed to hold them. The doghouse is then lifted to the tops of the supports.

Mount Gin Pole on Side Of Bin for Handling Ease

One contractor eases the handling of pipe and tools from the tool bin by mounting a gin pole along the side. A come-along is hooked into one of the eyes and the material is easily lifted from the bin to the pipe buggy for wheeling onto the derrick floor.



The boom is made from four-inch drill pipe with a three-inch brace across the top for added strength. Eyes are put in the bottom of the horizontal beam for the hook from the hoist. The boom is set into loops welded into the upright on the side of the bin. With this arrangement, it is only necessary to get a chain around the piece to be removed. The strength of the hoist will remove the piece without it being necessary to remove the pieces above.

Keep Coring Sheaves Ready, Yet Stored Out of Way

Where the coring reel is mounted on top of the drawworks, a simple arrangement for storing the sheaves, yet having them ready for instant use is shown. One sheave is permanently

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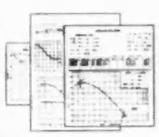

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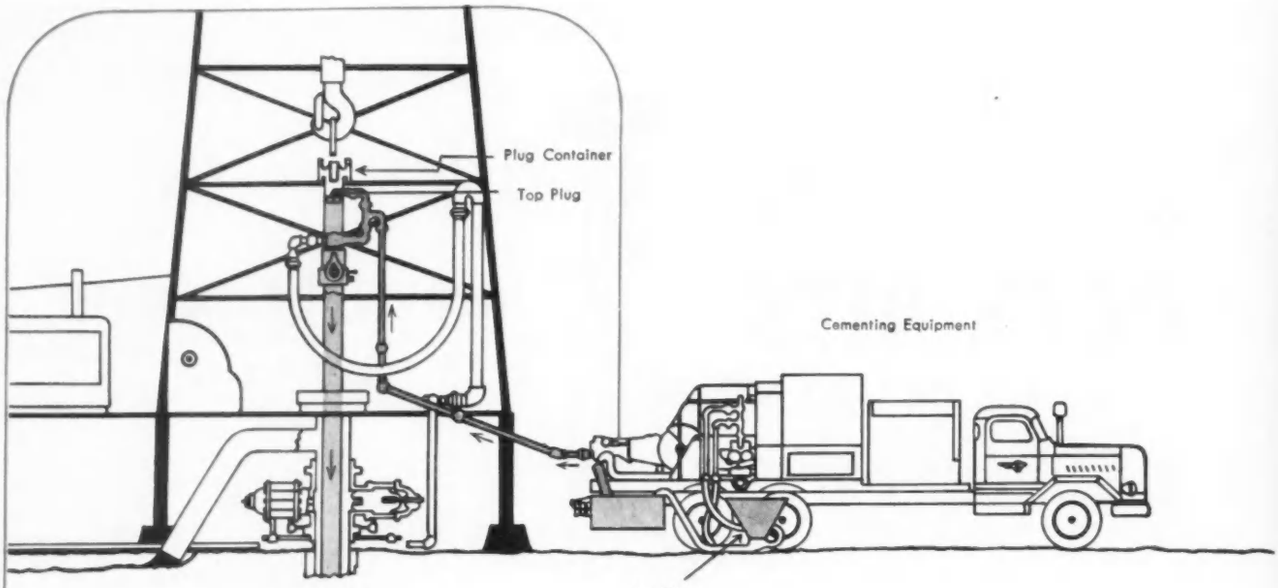

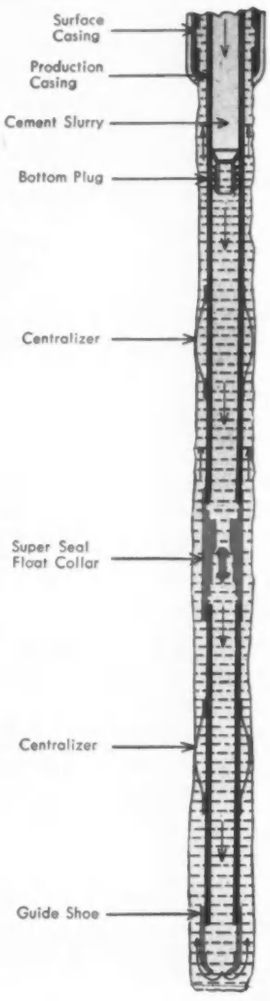

WHAT IS PRIMARY CEMENTING?

Primary cementing is the initial operation performed immediately after casing is run into the hole. It serves the basic functions of bonding pipe to formations, aids in protecting oil and gas zones and preventing migration of fluids within the well.

In primary cementing, the slurry is pumped out of the bottom of the lower shoe into the annular space outside the casing, as illustrated in the operational diagram at the left. A good primary cementing job is one of the most important factors affecting the producing period and the settled production rate of any oil well.

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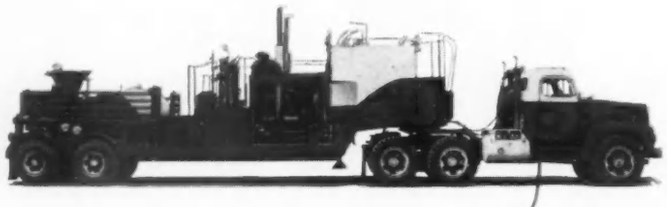

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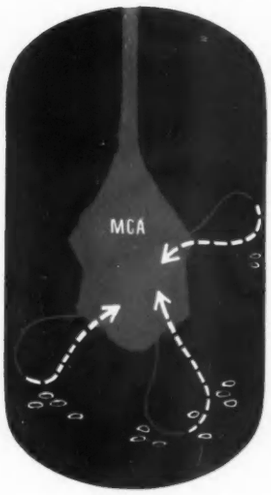
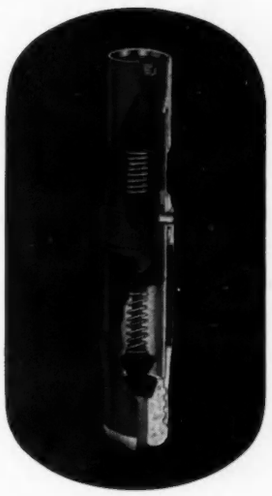
DUNCAN, OKLAHOMA

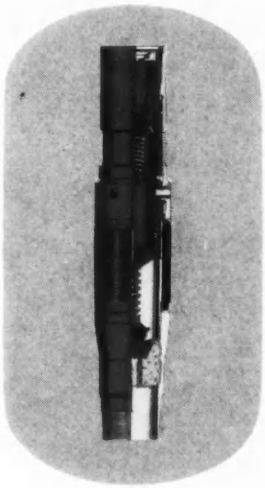
FOR MORE PRODUCTION, USE THESE HALLIBURTON PRODUCTS TO ASSIST YOUR WELL:



MCA, Halliburton's effective Mud Clean-out Agent, is used ahead of the cement slurry in primary cementing. Laboratory tests indicate that MCA is the most efficient mud dispersant available. It helps to clean out mud and soft filter cake in the annular space, reducing the possibility of channeling and providing a better cement bond to the formation.



FORMATION PACKER COLLAR is installed on casing above the shoe joint to help protect a lower formation from contamination while cementing. Several joints of casing or liner may be installed on lower end of packer collar; the packer is set and cement pumped down casing and out into annulus above expanded packer.



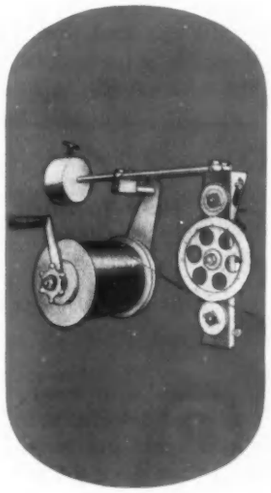
FORMATION PACKER SHOE, installed on the first joint of a string of casing, offers many advantages. This shoe is used in all areas where conditions require casing to be set on top of the producing formation, because:

1. Packer Shoe packs off open hole below casing, protecting low-pressure formations from cement contamination during cementing.

2. Packer Shoe floats in and guides casing to bottom.

3. Packer Shoe has a Super-Seal Back-Pressure Valve to keep cement slurry from backing up inside the casing above the Formation Packer Shoe.

4. Packer Shoe provides circulation of fluids through end of Shoe until shoe packer rubber is expanded and set.

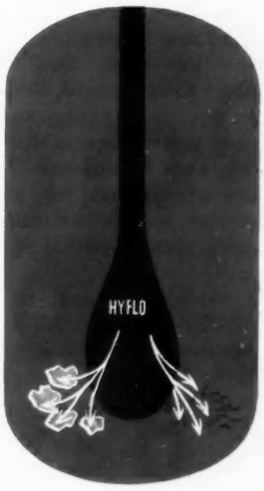


STANDARD MEASURING DEVICE for:

- Determining accurate measurements of well depths.
- Running instruments to obtain bottom hole temperatures, pressures, and fluid samples.
- Running crooked hole survey instruments.
- Surveying offshore locations that require precise linear measurements.

In addition to the Standard Measuring Device, Halliburton offers Heavy Duty, Extra Heavy Duty, and Super-Duty Devices. Whatever your needs, Halliburton has the device or combination of equipment to meet them.

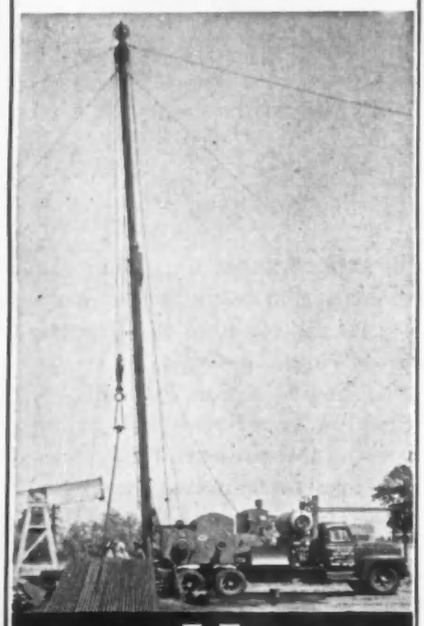
HOWCO HYFLO, an emulsion breaker, effectively removes water blocks and emulsions from productive formations, permitting oil to flow to the well bore with less resistance. Howco Hyflo is a surfactant which acts by greatly reducing the interfacial tension between the water and oil and minimizes the existence of stable emulsions.



CEMENTING SERVICES

284 SERVICE CENTERS—JUST MINUTES AWAY FROM YOUR WELL

They Pay Off BIG!



WICHTEX

Well Servicing Units

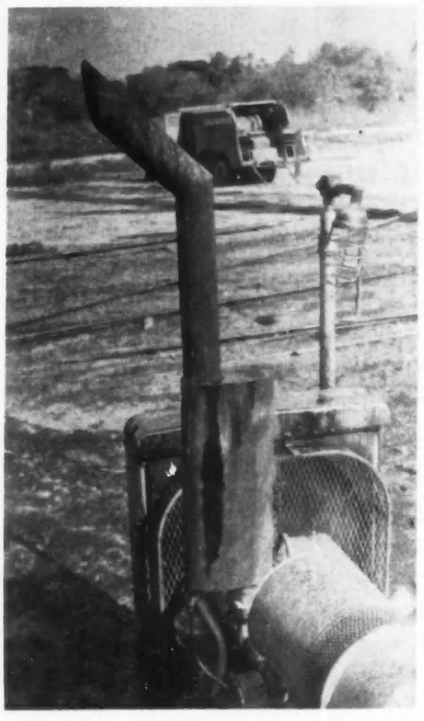
Wichtex units pay off three ways. First, they assure you fast, dependable operation that saves you job time, road time, and down time. Second, Wichtex units reduce costs. They are reasonably priced, economical to operate, easy to maintain. Third, they are unequalled for long, hard service without overhaul. Investigate these units! They pay off big!

Models range from 2,000′ to 12,000′ capacity. All models can be furnished with spudding attachment. Also investigate Wichtex Portable Rotary Rigs for 2,000′ to 5,000′ drilling.

WICHTEX MACHINERY COMPANY INC.
WICHITA FALLS TEXAS
Box 2250 Ph. 2-8612

mounted on a bar which allows it to slide back and forth as the wire line is unspooled. The other sheave has a threaded fitting and can be swung easily over into position over the drill pipe.

The wire line is spooled on the drum and the sheave is laid on top when over-the-road and when making hole. When it is necessary to pull a core, the loose block is pulled over into the derrick with a cat line and the core barrel attached and dropped into the drill pipe. As soon as the coring operation is finished, the sheave is put back on its place on top of the core line drum.



Simple Muffler Stops Unnecessary Rig Noise

A simple muffler for use around the rig may be fabricated easily by taking a piece of ten-inch line pipe and flattening it into an oval shape.

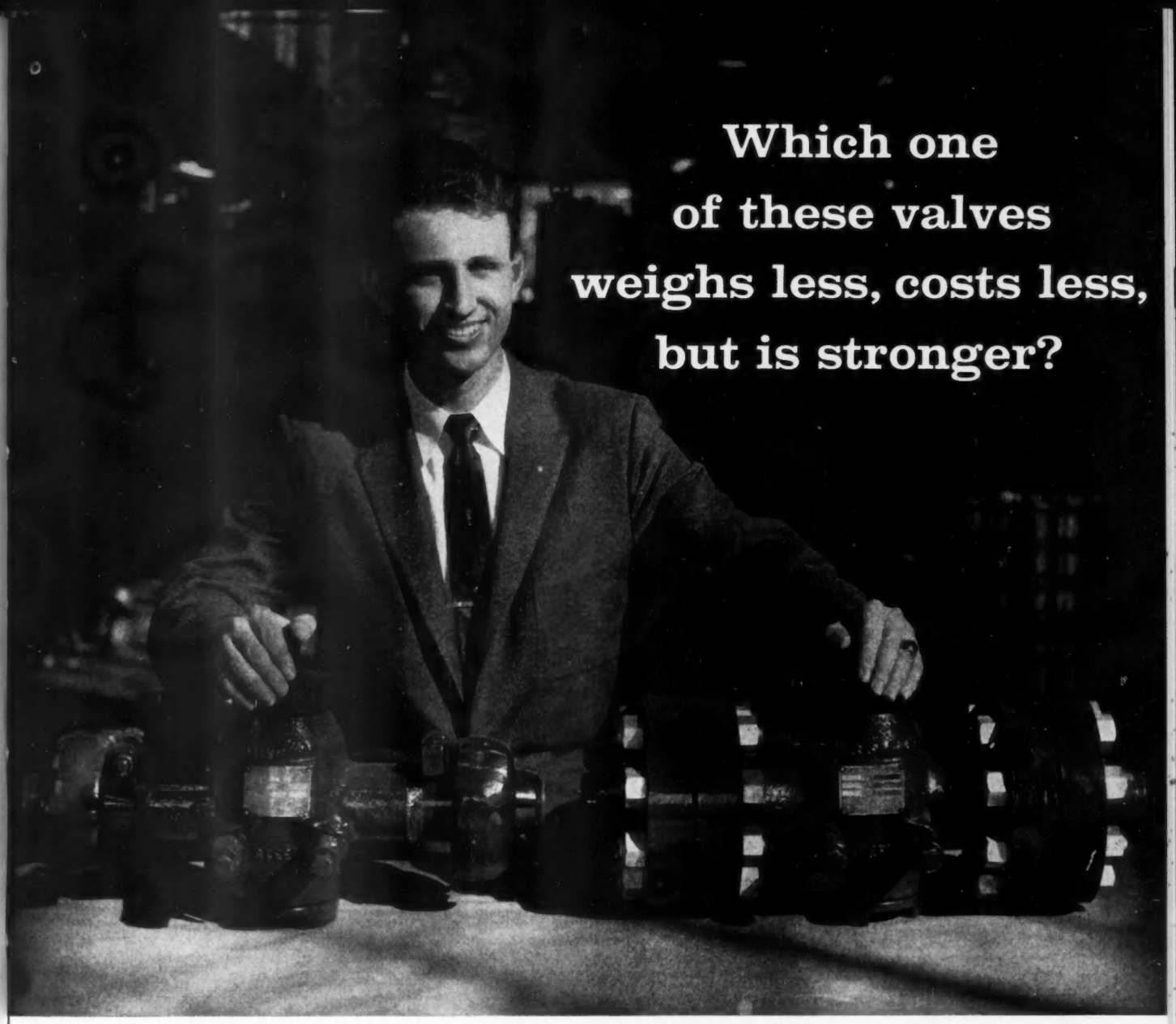
Pieces of four-inch pipe are welded into each end so that they slightly overlap each other and cause the direction of flow to be reversed. This cuts the noise level considerably without building up a noticeable back pressure on the manifold. The outlet line carries a dog leg near the top which directs the outlet away from the derrick and also prevents entrance of rain water when the engine is shut down.

Shopmade Support Adjusts Height of Suction Line

An adjustable support for the mud suction line may be made from material found around the yard. This one is made from scrap pieces of two-inch pipe which is bolted to the skid base of the pump unit. The drum for the wire line is set in between the two front legs. A ratchet and dog arrangement makes it easy to raise or lower the end of the suction line. An eye is welded to the nipple at the end of the suction hose, and the support line is tied to this eye and threaded thru a sheave which is hooked in an "S" link at the end of the support,

How-To-Do-It Ideas Earn Money, too!

WORLD OIL editors want how-to-do-it ideas, so your favorite short cut or invention could put money in your pocket! Write down the substance of your latest ideas and send them in with a picture or drawing of the installation . . . if accepted, $10 for each idea will be yours. Send those money-making ideas today to Hints Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas.



Both of these valves are of the same make, model, size, and pressure rating. One is equipped with 2″, 6000 lbs. test, Unibolt Couplings, the other with 2″, Series 900 flanges. The Unibolt-equipped valve weighs 102 lbs. less, costs about 10% less, and is approximately 28% stronger!

And the advantages don't stop there. Because it weighs less, the Unibolt-equipped valve costs less to ship and is easier to handle, easier to install. (Two bolts and nuts, compared to 16 bolts and 32 nuts.)

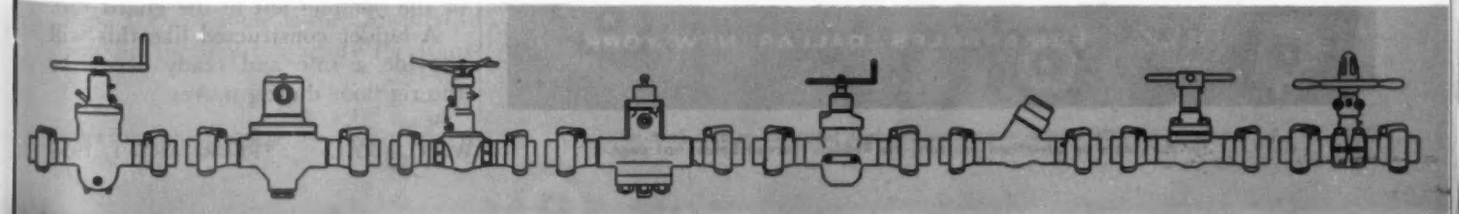
Unibolt Couplings are easy to attach to any valve. Either hub of the Coupling may be butt-welded, socket-welded or screwed to the valve body.

Even if steel were plentiful, Unibolt-equipped valves—as opposed to flanged valves—would be your best buy.

THORNHILL UNIBOLT **CRAVER CO.**

P. O. Box 1184, Houston, Texas

ask your supplier to furnish unibolt-equipped valves



It's NEW...

WEB WILSON SAFETY LOCK TUBING ELEVATOR

TYPE "SCT"

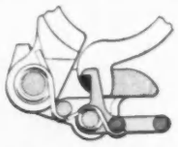
Here's the first and only SAFETY LOCK Tubing Elevator. Hooks that engage behind strong fingers keep the elevator closed safe from accidental opening. When a crew member manually opens the Safety Latch, the Main Latch also is released, and a strong spring mounted around the hinge pin automatically opens the elevator wide for easy removal of tubing.

Available at supply stores in two sizes: for 2" (2⅜" O.D.) tubing, and 2½" (2⅞" O.D.) tubing. Capacity, 65 tons; weight, 60 pounds; for links from 1¾" to 2¾".

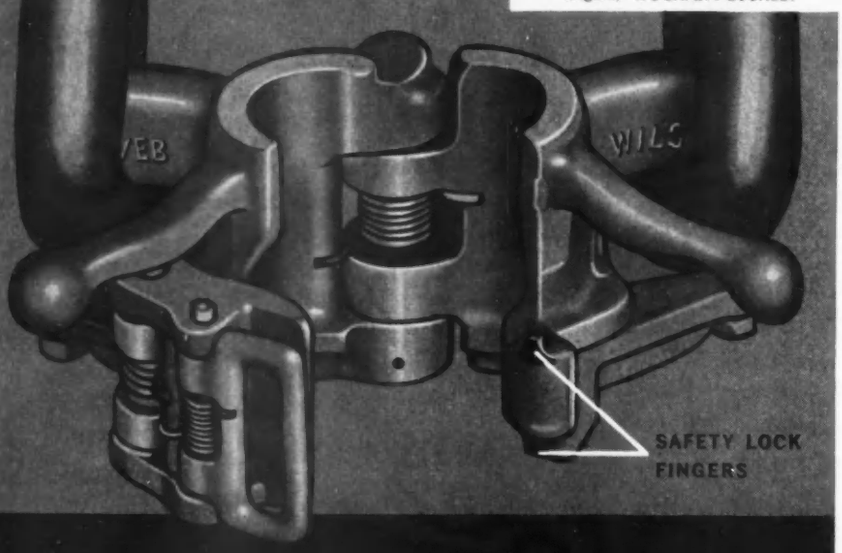
Why is one smart well servicing company using eighty (that's right, 80) of these elevators?

Any Web Wilson representative has your answer.

Heat treated, with a flame-hardened top wearing surface.



"Hooks" engaged behind the "fingers," it's SAFETY LOCKED.



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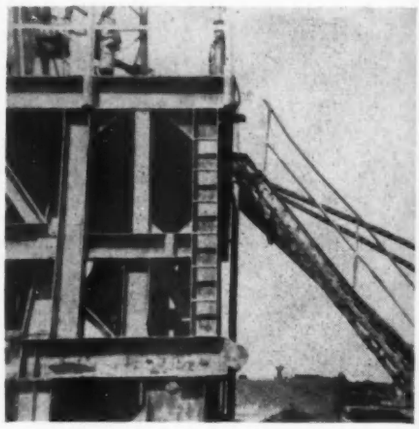
WEB WILSON

OIL TOOLS, INC.

LOS ANGELES DALLAS NEW YORK

then wound on the drum which carries the ratchet.

This boom arrangement can be left intact when the unit is carried between wells in the same field. If it is necessary to move it over the highway, the bolts at the base of the legs are removed, the legs taken out of the socket and the boom laid down over the mud pump.



Built-in Ladder Substitutes While Stairs Not Available

During rig-up and tear-down before the stairs have been installed, or after they have been removed, the crew men usually have quite a climbing job to do to get up on the floor. A built-in ladder in one of the "I" beams of the substructure is an added efficiency and a welcome addition to all rigs. The cost is very low requiring only a few short lengths of sucker rods and about an hour of a welder's time.

The rods are cut so they will reach from side to side of a vertical I-beam in the substructure of the rig. A corner I-beam that is easily accessible is chosen and the rods welded on the outside of the I-beam so that the recess of the beam will allow the climber to put his feet on the rungs. The rungs should be about 18 inches apart.

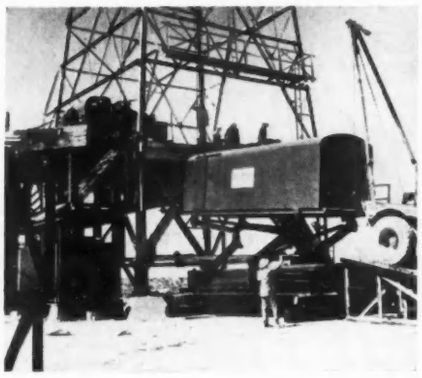
In the photograph the horizontal skid beam at the bottom of the substructure is used as the first step in the ladder. When the rungs are all welded into place, it is usually necessary to cut a gate in the guard rail around the rig floor. This will require a new post being welded to the ends of the opening left in the guard rail.

A ladder constructed like this will provide a safe and ready access to the rig floor during moves.

Fold-Up Doghouse Legs Save Lost Time in Moving

The up-to-date contractor tries to combine as much of his equipment as possible since unitization is the key to fewer loads and simplified rig-up and tear-down. This results in less lost time in moving.

The unique design of the doghouse shown in this picture results in a single unit containing the junk bin doghouse supports the doghouse. This enables the contractor to transfer the entire unit in one load. The tool or junk bin is skid-mounted and the sides are approximately 20 to 24 inches in height. This forms the base for the doghouse. The supports or legs of the doghouse are of I-beam construction, and each beam has an interlocking hinge joint on each end. This joint enables the supports to be collapsed and carried as part of the packaged unit. To set up the doghouse, the unit is spotted on location; then by means of a gin pole or catline, the doghouse is raised until the



supports are straight. This causes the hinge joints to lie up, and pins are driven to lock the joints in place, and the doghouse is ready to use. By using sliding doors, space is saved that is normally used in opening and closing, and some protection against bending and other damage is afforded.

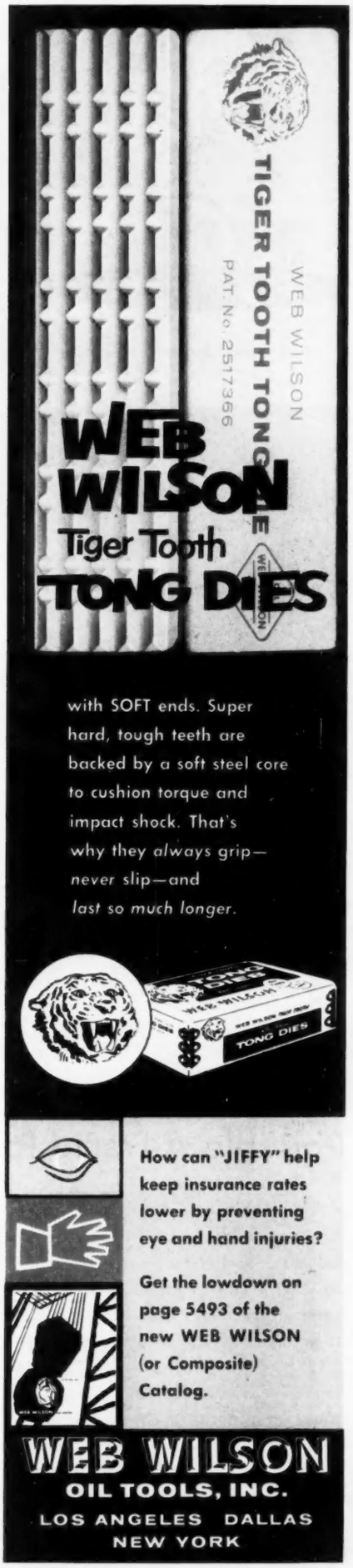
When tearing down, the doghouse is lifted slightly to relieve the pressure on the pins, and the pins are removed from the hinge joints of the legs. The doghouse is then lowered to rest on the tool bin ready for transfer.

Store Roofing Paper Near Exhaust Manifold

Roofing paper has been used very frequently around drilling rigs as a matting on board walks, stairways, pipe walks and rig floors to minimize slipping by rig personnel when these surfaces become wet from mud, rain, grease and other material. Carpeting walkways with this rolled roofing paper has eliminated many spills and accidents.

Roofing paper, due to its rough texture is a simple, effective, but inexpensive means to obtain sure footing under these working conditions.

Crews working on operations that are located in areas with constant low temperature climatic conditions have the problem of laying the roofing paper when it is brittle and difficult to handle. One drilling contractor solved this problem by storing the spare rolls of roofing near the exhaust manifold of the diesel engines in the power shed. Heat from the manifold maintained the paper at a higher temperature so that it was easily unrolled and handled when laying. Laying the paper when it is at a low temperature makes the crews job more difficult. It will not lay flat and could possibly cause tripping and injury from the brittle upturned edges.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with SOFT ends. Super hard, tough teeth are backed by a soft steel core to cushion torque and impact shock. That's why they always grip—never slip—and last so much longer.
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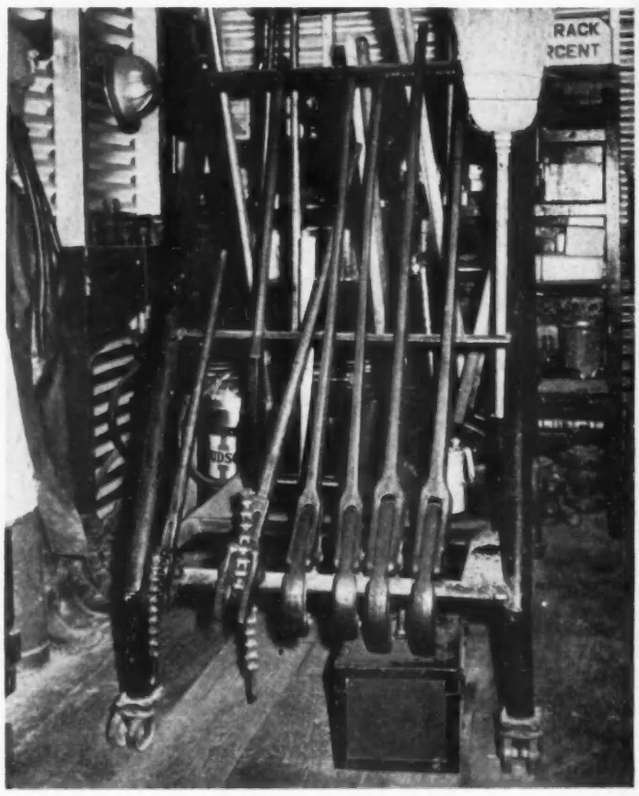
PRODUCTION HINTS

These How-To-Do-It Ideas Can Save You Money

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas.



Portable A-Frame Rack Solves Tool Storage Problem

A portable tool rack, as shown in the picture, aids in maintaining an orderly and systematic place to store lay tongs, chain tongs, yo-yo's, rakes, hoes, shovels etc. that are constantly in demand by the roustabout gang.

One operator minimized the problem of maintaining an orderly warehouse by mounting the A-frame rack on rollers. Tools stored on the unit were off the floor and in the proper indicated position. The unit was built from scrap 2½ and 1-inch pipe with sheet metal for the base. Legs were cut to approximately 12 to 14 inches in length and welded to horizontal pieces forming the base on which the sheet metal was welded. Risers five or six feet in length were welded at an angle to each corner of this base and joined at the top with a hoizontal 2½-inch member supported in the center of each end section with a one-inch brace member and also supported in the A-frame section with welded short sections of pipe.

Chain tongs and lay tongs are wrapped around the base horizontal member as shown in the picture and lie back on the framework out of the way. Other tools are placed on the base platform in special positions and holders that are made from scrap sheet metal. Note that holders for the broom, sledge hammer, yo-yo etc. tend to keep the tools in systematic order giving the warehouse a neat appearance. Whenever roustabouts are given an assignment requiring the use of tools in the warehouse, it is an easy matter to find the right one in the right spot.

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Security

SECURITY ENGINEERING DIVISION, Dallas, Tex., Whittier, Calif. — Rock bits, reamer rock bits and hole openers; reamers, casing scrapers and Neo-Rod rubber stabilizers.

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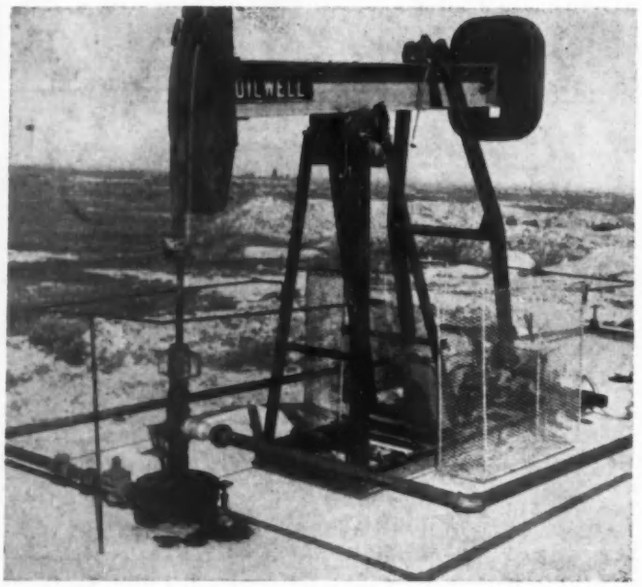
Pumping Unit Guard Affords Protection

Maximum protection is provided in this pumping unit guard installation for not only the horsehead and well end, but crank and prime mover areas as well. Accessibility is featured in this design, also. The simple rectangular guards both front and back prevent anyone from accidentally walking into the moving machinery, yet are so positioned as to allow the pumper to service the stuffing box; also start and stop the motor and operate the brake without having to remove the guards.



The crank or central portion of the unit, screened in with expanded metal enclosures from pad level up, prevents anyone from getting his limbs, tools or pipe fittings caught in the small area between ground level and the crank as the latter reaches the lowest point of its rotational path.

Lubrication fittings also are installed so as to eliminate removal of the guards for routing servicing of bearings. As can be seen, the saddle bearing fittings is brought down with pipe extensions to put it within reach of a man standing on the ground. Wrist pins are lubricated with similar extensions but which are brought up and strapped to the sides of the pitmans; putting those fittings within easy reach of a man standing beside the guard.

Inject Inhibitor Into Casing By Equalizing Pressure

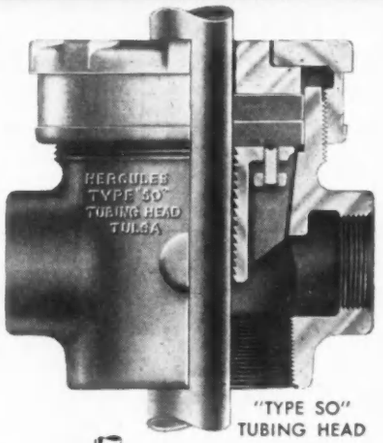
The injection of chemical inhibitor into a well's casing annulus for corrosion control is often a difficult task when injection is desirable by gravity flow into a high pressure annulus area. One operator obtained a satisfactory gravity flow lubricator system on one Gulf Coast installation by equalizing the pressure differential from the casing head to the lubricator.

The chemical inhibitor is placed

there's a Hercules tubing head

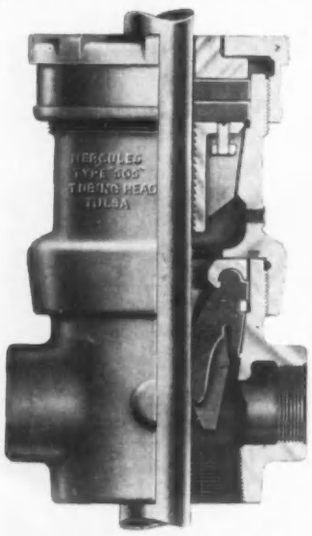
TO FIT YOUR REQUIREMENTS...

HERCULES "Type SO" Tubing Head is particularly suited for pumping due to compactness (only 12½" high). Stripper rubber can be used in body for running or wiping tubing. Also ideal for intermittently flowing wells.



"TYPE SO" TUBING HEAD

HERCULES "Type SO" and "SOS" Tubing Heads are the favorite of successful operators because of their simplicity, ruggedness and ease of operation. Available in 4½" OD to 7" OD Casing Sizes to suspend 2", 2½" or 3" tubing. Constructed from pressure cast steel and tested to 4,000 PSI. Slips are hinged for ease of installation and positive alignment.



"TYPE SOS" TUBING HEAD

HERCULES "Type SOS" Stripper Tubing Head is unsurpassed for use in well servicing operations as well as on flowing wells. It consists of a HERCULES "Type SO" Tubing Head with a bowl and Neoprene Tubing Stripper.

HERCULES TOOL Company

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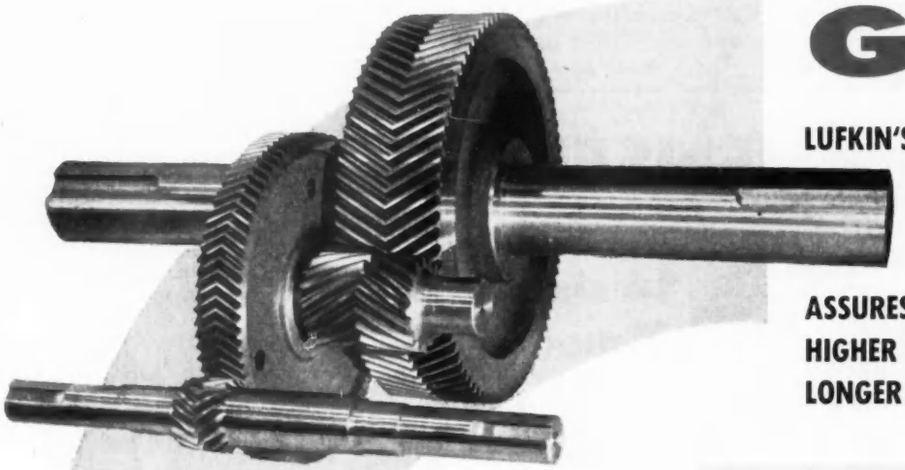

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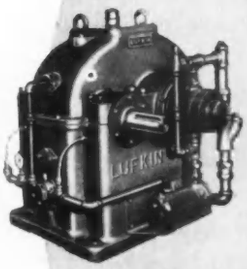

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"precision" means . . .

- CORRECT PROPORTIONS
- ACCURATE TOOTH SPACING
- EXACT HELIX ANGLE
- PERFECT TOOTH CONTOUR
- FINE SURFACE FINISH
- PROPER ALIGNMENT.

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Lufkin equipment in Canada is handled by
THE LUFKIN MACHINE CO., LTD., 9950 65th Avenue, Edmonton, Alberta, Canada, Regina, Saskatchewan, Canada

into the lubricator through a plug valve that is welded into the lubricator on one end. After bleeding off pressure on the system, the pumper places a funnel in the plug valve and fills the lubricator with the desired chemical inhibitor at periodic intervals. The inhibitor flows by gravity through a ¾-inch line tied into the regulating valve which is made up into the casing side of the tree. In order to equalize the pressure differential across the lubricator, a ¾-inch line was installed in a tee-connection made up on the casing flange of the tree and tied back into the top of the lubricator as shown in the picture. If the casing pressure is 3000 pounds per square inch, for example, the pressure in the chemical lubricator is 3000 psi, and gravity flow is maintained back into the casing due to the pressure equalization across the top of the lubricator. A ¾-inch line is also placed

in the top of the valve near one end of the lubricator in order to bleed off pressure or clean out the system.

If valves on the gravity flow line and equalizer line are closed, pressure is removed from the lubricator system by opening the valve in the clean-out discharge line located on top of the lubricator. This is the customary procedure to remove pressure from the system when it is desirable to re-fill the lubricator.

The lubricator was built from scrap surface casing and mounted on angle iron supports that are set into the ground for a permanent installation. Each angle iron leg is bolted to short L-shaped segments of angle iron that are welded to the bottom of the lubricator. Each leg is supported with cross braces of angle iron welded diagonally to each leg.

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14 sizes
22 models

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What's Happening

among MEN in the INDUSTRY

Standard Oil Company (Indiana) made four new appointments in the Engineering and Engineering Research departments. **Fred W. Scheineman** was named director of engineering; **Thomas A. Abbott,** engineering administration manager; **Dr. Robert B. Jacobs,** engineering research manager, and **George M. Keranen,** General Engineering department manager. Previously a single director of engineering and engineering research was in charge of the two departments. This post has been held by **George W. Watts** whose retirement was announced earlier. Scheineman has been manager of the General Engineering department since the department was established in 1954. The past five years Abbott has been manager of the Engineering Research department, the first to hold that post. Dr. Jacobs has been technical director of the Engineering Research department since 1952. Since 1954 Keranen has been assistant manager of the General Engineering department.

•

Norman Hardy, executive vice president of the **Arabian American Oil Company,** has been elected president. He succeeds **R. L. Keyes,** who is retiring. Hardy has also been made chief administrative officer and a director of the company. Hardy began his oil career in 1926 as a geologist with the Standard Oil Company of California. He has worked in Indonesia, Holland and South America, as well as in the U. S. Prior to joining Aramco in 1951, Hardy was president of the Richmond Petroleum Corporation, a subsidiary of Standard of California. His headquarters will continue to be in Dhahran, Saudi Arabia.

Norman Hardy

•

George R. Alewyne, Jr., has joined **Durbin Bond & Co., Inc.,** of Little Rock, Ark., as geologist. Prior to joining the company, Alewyne had been with Carter Oil Company for the past seven years.

•

Walter Randall has been employed by **Plymouth Oil Company** as regional geologist of the Rocky Mountain region with headquarters in Denver. After ten years with The Atlantic Refining Company, Randall resigned in February of 1957 to become a consulting geologist, in which capacity he has remained until his employment by Plymouth Oil Company.

H. W. Blauvelt

L. J. Richards

Hudson's Bay Oil and Gas Company Limited has announced the appointments of two senior vice presidents and a financial vice president. **L. J. Richards** has been appointed senior vice president. He joined the company at Calgary in 1948. **H. W. Blauvelt** is the other newly appointed senior vice president. Blauvelt joined Continental Oil Company in 1952 as assistant controller and held that position until accepting his new appointment with Hudson's Bay Oil and Gas. **K. H. Burgis,** financial vice president joined Hudson's Bay as treasurer and secretary in 1955.

K. H. Burgis

•

J. W. Wilson has been promoted to regional geophysicist for **Continental Oil Company's** Central region, with headquarters in Oklahoma City. Formerly assistant southern regional geophysicist for Conoco at Houston, he succeeds **E. L. Mount,** who recently was promoted to superintendent of the Geophysical section's Operations division at Ponca City, Okla. Wilson joined Conoco in 1944 and served on geophysical crews in several states and as a geophysical supervisor at Ponca City and Houston before his promotion to assistant regional geophysicist at Houston in 1953.

•

Walter H. Helmerich has been named to the executive committee of the **International Petroleum Exposition.** The next exposition will be held May 14-23, 1959. Helmerich is president of White Eagle Oil Company and Helmerich & Payne, drilling contractor subsidiary.

•

Dale (M. D.) Myers has announced his plans to enter the field of consulting geology offering services in exploration, de-

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velopment, evaluation and supervision. His office will be at 1056 Claiborne Avenue, Jackson, Miss. Myers resigned his position of senior geologist with the Pan American Petroleum Corporation after having completed 20 years of service. Immediately prior to that, a period of 1½ years was spent as a field geologist with Stanolind Oil & Gas Company's Core Drill program in south Alabama and west Florida.

•

Fred H. Wilcox

H. J. Schmidt

Herman J. Schmidt, general counsel, and **Fred H. Wilcox,** manager of the Producing department, were elected to the board of **Socony Mobil Oil Company, Inc.** Wilcox joined the Vacuum Oil Company in 1927, and was one of the first geologists to explore the West Texas-New Mexico area. Magnolia (Socony Mobil's affiliate in the Southwest) appointed Wilcox assistant chief geologist in Dallas in 1944. He came to New York as coordinator of domestic production for Socony Mobil in 1949, and became manager of the Producing department in 1953. Three years later he also was named chairman of the producing committee, with the job of coordinating and supervising the company's exploration and production activities throughout a large part of the Free World. Schmidt was with the law firm of Cravath, Swaine and Moore in New York before joining Socony Mobil as tax counsel in 1951. He was named associate general counsel in 1955 and general counsel the following year. As a director, he retains his duties as general counsel.

•

Arthur G. Levy, petroleum engineer, announced his recovery from an injury sustained in March, 1957, and the resumption of his practice as an oil and gas consultant in Houston.

•

Richard J. Murdy, system planning engineer with **New York State Natural Gas Corporation,** has been transferred to New York City from Pittsburgh, Penn., where he formerly served as chief geologist of the same firm.

•

Cable Engineering, Wichita Falls, Texas, announced the association of **Nathan M. Avery.** He was formerly with The Texas Company as a petroleum engineer on the Gulf Coast.

•

Austral Oil Exploration Company Incorporated announced the following promotions in their Houston office. **Winston Glenn Smith** has been promoted to chief

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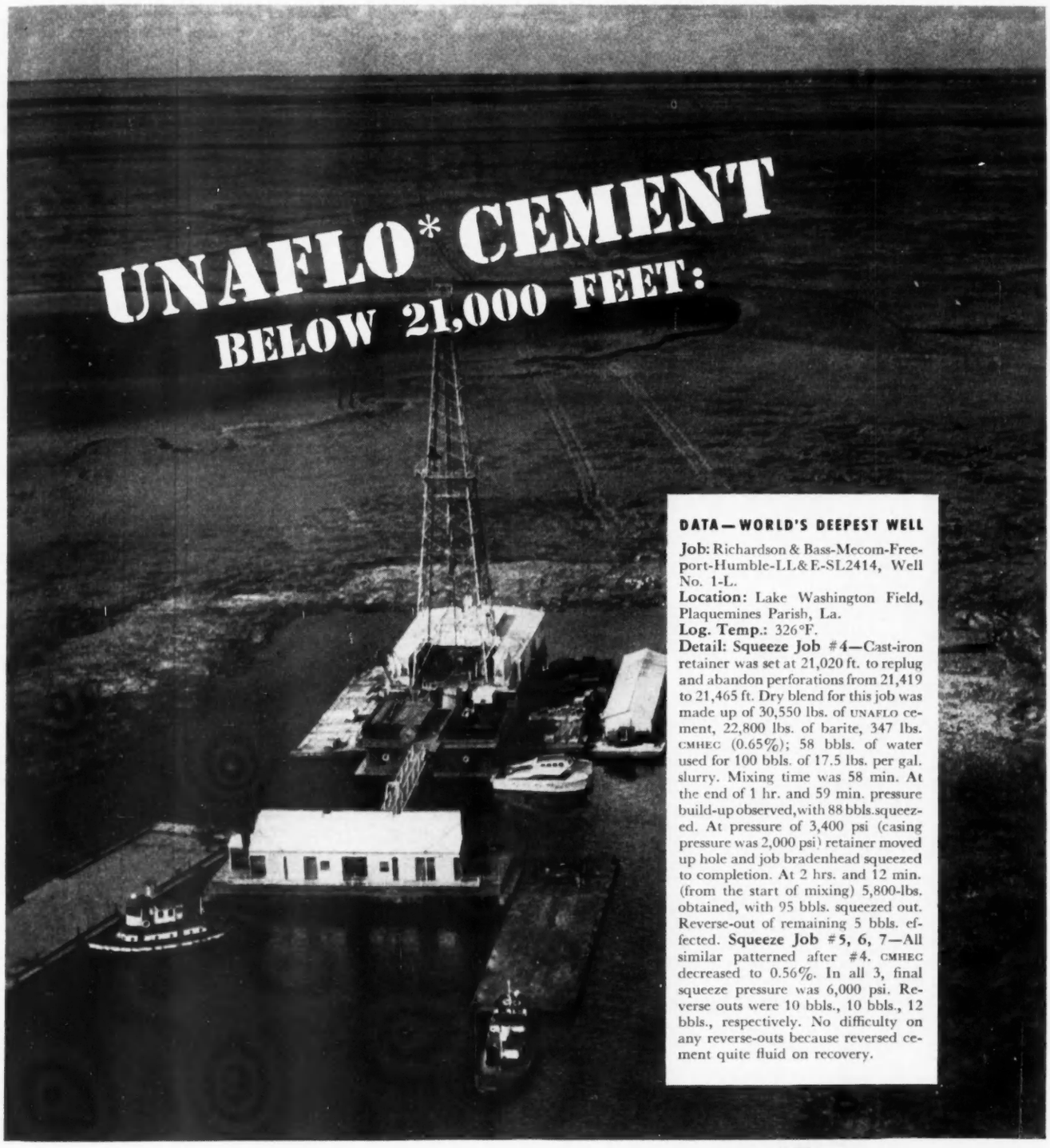

DATA—WORLD'S DEEPEST WELL

Job: Richardson & Bass-Mecom-Freeport-Humble-LL&E-SL2414, Well No. 1-L.
Location: Lake Washington Field, Plaquemines Parish, La.
Log. Temp.: 326°F.
Detail: Squeeze Job #4—Cast-iron retainer was set at 21,020 ft. to replug and abandon perforations from 21,419 to 21,465 ft. Dry blend for this job was made up of 30,550 lbs. of UNAFLO cement, 22,800 lbs. of barite, 347 lbs. CMHEC (0.65%); 58 bbls. of water used for 100 bbls. of 17.5 lbs. per gal. slurry. Mixing time was 58 min. At the end of 1 hr. and 59 min. pressure build-up observed, with 88 bbls. squeezed. At pressure of 3,400 psi (casing pressure was 2,000 psi) retainer moved up hole and job bradenhead squeezed to completion. At 2 hrs. and 12 min. (from the start of mixing) 5,800-lbs. obtained, with 95 bbls. squeezed out. Reverse-out of remaining 5 bbls. effected. **Squeeze Job #5, 6, 7**—All similar patterned after #4. CMHEC decreased to 0.56%. In all 3, final squeeze pressure was 6,000 psi. Reverse outs were 10 bbls., 10 bbls., 12 bbls., respectively. No difficulty on any reverse-outs because reversed cement quite fluid on recovery.

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engineer of the company. **C. R. Geffs** has been promoted to Texas-New Mexico district engineer. Promotion in Austral's Lafayette, La., district office are as follows: **I. R. Chalmers** is promoted to district production superintendent. **Raymond Ellison** is promoted to district drilling superintendent.

•

Charles B. Towill has been named public relations representative for the Fifth World Petroleum Congress, Inc., with headquarters at 527 Madison Avenue, New York 22. Towill was formerly manager of public relations for Iranian Oil Participants Ltd., in London. The six-day Congress will open in the New York Coliseum on May 31, 1959.

Les Clutter has accepted a position as research geologist with Sun Oil Company in Billings, Mont. He was formerly with Gulf Oil Corporation as a geologist. Five and a half of his 6½ years with Gulf were spent in the Williston Basin area.

•

Harry D. Dobe has been appointed assistant maintenance superintendent of **Great Northern Oil Company.** Previously associated with Esso Standard Oil Company at Baltimore since 1950, Dobe served as Esso's head of maintenance and construction planning and coordination before joining Great Northern.

Shell Oil Company designated **A. J. Galloway** an executive vice president of the firm. Galloway has been vice president in charge of Shell's exploration and production activities since 1948. He will continue to be responsible for this phase of the company's business. Galloway joined Shell in California as a geologist in 1926. He had been exploration and production vice president for the Mid-Continent and later for the Texas-Gulf area and the East of the Rockies territory before being made vice president in charge of the company's nationwide exploration and production operations. He has been a director of Shell Oil Company since 1953.

A. J. Galloway

•

W. B. Cleveland, formerly manager of Creole Petroleum Corporation's Amuay refinery at Las Piedras, Venezuela, has been elected a member of the board of directors of **The Carter Oil Company.** He had more than 19 years service with Standard Oil Company (N. J.) affiliated companies in South America. Between 1938 and 1952 he held several producing operation positions with Creole Petroleum Corporation including the post of manager of the company's Western division at Maracaibo, Venezuela. In 1952 he transferred to Creole's Marketing department in Caracas and became manager of the department in 1955. In January, 1956, he was named manager of Creole's Amuay refinery, a position which he held until July of this year. For the past three months Cleveland has been on a special assignment for Standard-Vacuum Oil Company in Indonesia and The Hague, Holland.

•

T. M. Vail has been elected secretary of **General Petroleum Corporation.** He succeeds **James A. Grace,** who retired December 1. Vail, attorney and assistant secretary prior to his promotion, has been with General Petroleum for 28 years. He joined the company as a sales attorney, and has held various positions since 1929, including district sales manager in Pasadena and special representative. Grace is retiring after 21 years of service. He has been secretary of the corporation since the first of last year and manager of the contract bureau since 1944.

•

Ralph Ludwick, field superintendent for **Pan American Petroleum Corporation,** has been transferred from Hays, Kansas, to Ulysses to supervise the company's Hugoton area producing operations. Ludwick replaces **W. M. Warren,** who has been as-

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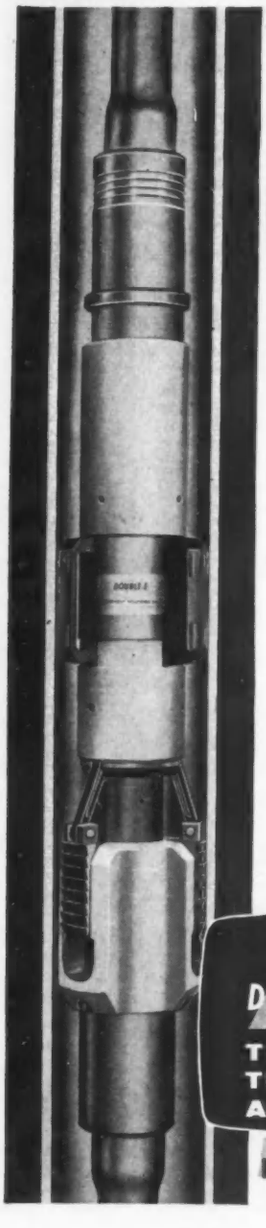

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signed as field superintendent for Pan American's West Edmond, Okla., area. He joined Pan American in 1931, the year the company was organized, as a meterman at Desdemona, Texas. He has held engineering and supervisory assignments in Wewoka, Okla., in Kansas, and in East Texas.

•

The Texas Company has formed a new department with headquarters in New York; the Foreign Producing department (Western Hemisphere and West Africa) is intended to consolidate the responsibility for all of Texaco's exploration and producing interests in Canada, Latin America and West Africa into one department. Recent acquisitions in Trinidad are included. **L. B. Derby** has been namd general manager of the new department. Derby has been with Texaco since 1927, two years after receiving his B.S. degree from Virginia Military Institute. He has held several domestic and many overseas posts with the company.

L. B. Derby

DEATHS

Charles Calvin Toomey, 65, Tulsa, president of Toomey Oil Co., died November 15. He was president until 1952 of the old Midco Oil Corp., which he dissolved in that year to organize the company bearing his name.

Russell H. Gwinner, 62, vice president of the Oil Loan division of The First National Bank & Trust Co. of Tulsa and petroleum engineer, died November 18.

Edwin Lewis Mayes, 81, retired oilman, died November 11.

Raymond William Gutzler, independent Oklahoma oil operator, died in Dallas November 6. He went to Oklahoma several years ago and was responsible for the development of some of the important Oklahoma oil discoveries.

Harrison G. Davies, 78, former president of Superior Oil Co., died October 9 at Wauconda, Ill. Davies headed Superior until it was absorbed by Sunray Oil Corporation. In 1930 he became vice president of Socony Mobil Paint Products Co. and moved to Chicago, holding that position for ten years until he retired and moved to Wauconda.

E. Hammond Jones, 82, former partner in the old Palmetto Oil Co., Tulsa, died November 25.

Ira G. Watkins, 60, owner of the Watkins Drilling Company which has operations in Oklahoma, Texas and Illinois, died November 24.

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BOOKS

OIL & PETROLEUM YEAR BOOK, 1957 Edition, Compiled and published by Walter E. Skinner, 20, Copthall Avenue, London, E.C.2, $6.

The 1957 issue of the yearbook has been published for the forty-eighth time. The new edition contains complete and up-to-date particulars of 1070 of the principal British, American, Canadian and foreign oil companies, operating in all parts of the world, and covering all branches of the industry.

The sections include "Manager's, Engineers and Agents," "World Crude Oil and Natural Gasoline tables," and "Buyers' Guide." Also included are three maps, printed in red and black, showing Canada's oil and gas fields and pipe lines, Trans-Canada natural gas transmission system, and Middle-East oil fields, refineries, pumping stations and pipe lines.

•

ENGINEERING PROGRESS AND THE OIL INDUSTRY, The Institute of Petroleum, 61 Cavendish St., London W. 1, England, 30 shillings.

The book contains six comprehensive papers on civil engineering, mechanical engineering, electrical engineering (in two parts), marine engineering, metallurgy, and chemical engineering, together with discussions of each paper.

The papers were presented at the 1957 summer meeting of the Institute of Petroleum held at Folkestone, N. C., May 29-June 1, 1957. They were edited by George Sell, F. Inst. Pet., and editor of Institute of Petroleum Review.

The hard-back covered book contains 168 pages, including 30 pages of advertising matter.

In the U. S. those interested in obtaining copies may arrange for payment by draft obtained at their local bank.

•

1958 OIL DIRECTORIES, Midwest Oil Register, Drawer 7248, Tulsa.

The revised 1958 oil directories give the names, titles and mail addresses of over 80,000 important oil men who purchase or influence the purchase of equipment used in all branches of the oil industry in the world.

They are pocket size and plastic bound —designed especially for sales executives who need a quick reference manual that can be carried conveniently.

The books cover producing and drilling, refining, petrochemical and natural gas processing plants of the world, pipe line and pipe line contractors and others.

•

IRA RINEHART'S HARDEMAN, JACK AND KNOX COUNTIES REFERENCE BOOK, Rinehart Oil News Company, Box 1208, Dallas.

This is the third volume of the series of five North Texas area books covering oil and gas developments in Texas Railroad Commission District No. 9. It covers 264 fields in Hardeman, Jack and Knox counties.

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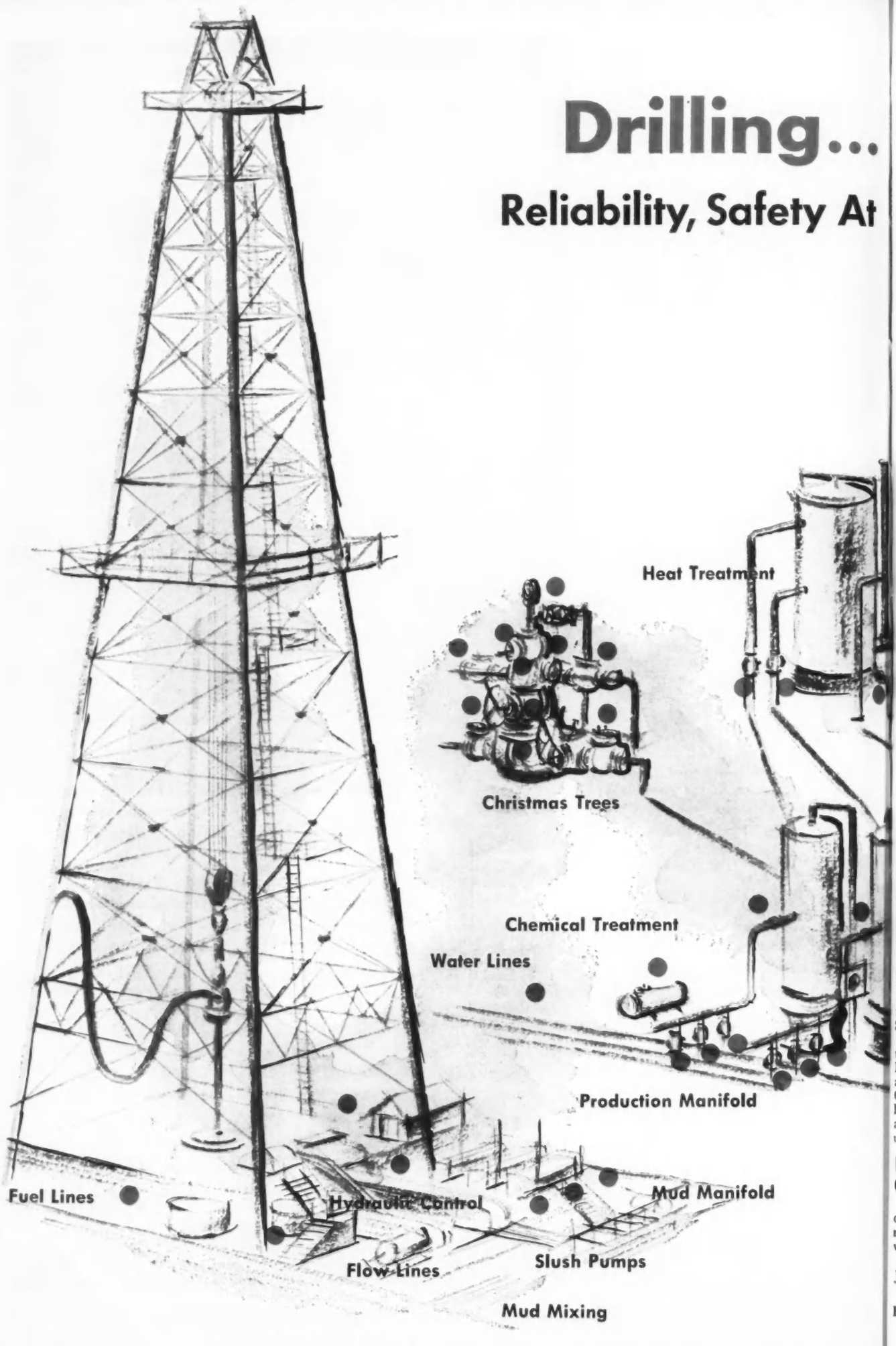

what's Happening

among INDUSTRY ASSOCIATIONS

Los Angeles Nomad Newcomers

Three new members of the Los Angeles chapter of Nomads inducted at the December, 1957, meeting are shown between Earl Daniels of Hydril Company (left) and Art Marshall of H. C. Smith Oil Tool Company, ritual master. Left to right: Harry G. Smith of A. O. Smith Corporation, regular member; Lee M. Boortz of Halliburton Oil Well Cementing Company, associate member; Thornley (Tiny) Roe of Halliburton Oil Well Cementing Company, associate member.

Houston Foreign Guests

Foreign guests present at the December meeting of Nomads in Houston are left to right: E. A. Barrall, Socony-Mobil, Calgary, Alberta, Canada; J. Worsdall, Cameron Iron Works, Mexico City; Dr. J. Brian Eby, Houston, guest speaker; Hassan Marzia, Iran Oil Co., Teheran, Iran; J. C. Robbins, Iran Oil Co., Teheran; and W. E. Armentrout, Southeastern Drilling Co., Teheran.

John Pearce Is President Of 1958 Tulsa Nomads

At a recent meeting, the Tulsa chapter Nomads elected the following officers to service during 1958:

John Pearce, Superior Iron Works & Supply Co., president; Oscar Irrizarry, editor Petroleo Interamericano, vice president; T. M. Lumly, president of The Refinery Engineering Co., secretary; Harry S. Horton, Tretolite, treasurer;

Floyd C. Cummings, Axelson Manufacturing Co., assistant treasurer; Vern W. Bailey, Bethlehem Supply Co., sergeant-at-arms; E. M. Donovan, Martin-Decker Corp., deputy sergeant-at-arms; Guy Williams, Dowell Incorporated, senior regent; and Paul V. McGivern, McKissick Products Corp., junior regent.

Desk and Derrick Club Chooses 1958 Officers

Ann Hignett, DuPont, is the 1958 president of the New York City Desk and Derrick Club. Nell Hagaman, Shell Oil Co., was named vice president.

Other 1958 officers include: Edith M. Jones, Commonwealth Gas, recording secretary; Agnes E. Blackburne, Caltex, corresponding secretary; Loretta Helmbrecht, The Texas Company, assistant corresponding secretary; Doris I. Kendrick, Richfield Oil Corporation, treasurer; Mary Tierney, Tidewater, assistant treasurer.

Directors elected for a two-year term are Helen N. Brenner, Standard-Vacuum; Emily G. Clark, Buckeye Pipe Line; and Meta A. Martin, Standard (N. J.).

AAPG and SEPM to Hold Joint Los Angeles Meeting

The forty-third annual meeting of the American Association of Petroleum Geologists will be held in Los Angeles next March 10-13. Convention headquarters will be at the Biltmore Hotel, and technical programs will be held at the Philharmonic Opera House.

The convention, held jointly with the Society of Economic Paleontologists and Mineralogists, will attract several thousand persons engaged in the geological sciences from the U. S., Canada, Mexico and South America.

Convention committee chairmen were

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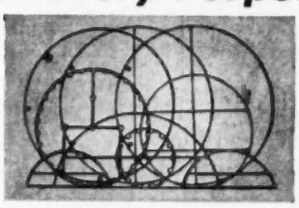
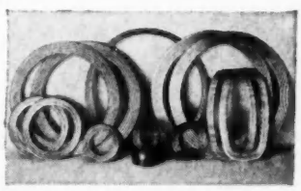


HEAT EXCHANGER GASKETS
Made in any size or shape needed in double jacket type. Also cut from solid metal or sheet packing. Write for Bulletin 564.



CORRUGATED METAL GASKETS
Plain or jacketed type. Made of ingot iron, aluminum, stainless steel, copper, brass, nickel and monel in all sizes and shapes. Write for Bulletin 565.
PROMPT DELIVERIES
CHICAGO-WILCOX MFG. CO.
7705 So. Avalon Ave., Chicago 19, Ill.

announced by Leo R. Newfarmer, general chairman and exploration manager for Shell Oil Company, and Mason L. Hill, vice chairman and chief geologist for Richfield Oil Corporation.

Appointees include Newfarmer, Hill, J. D. Bainton, representing the SEPM and H. W. Lee, president of the Pacific section of the AAPG, planning; John C. Hazzard, Union Oil Company, technical program; G. W. Ledingham, Western Gulf Oil Company, entertainment.

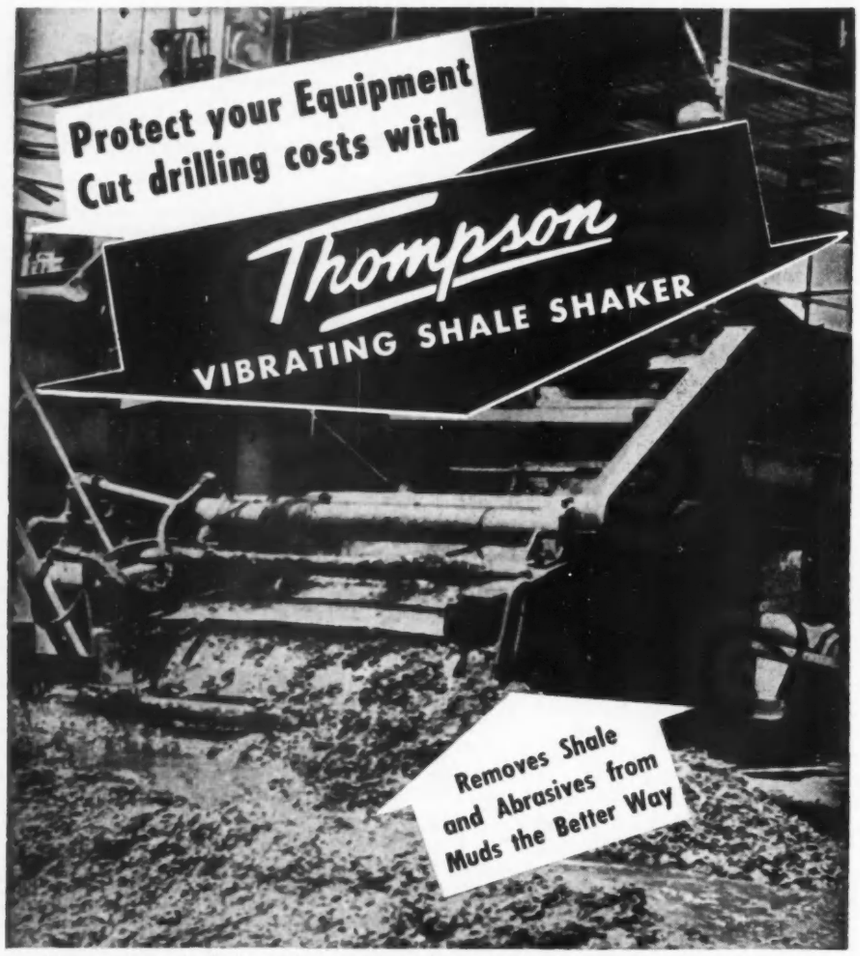
J. T. Isberg, Superior Oil Company, student interview; H. H. Sullwold, University of California at Los Angeles, field excursion; Frank B. Carter, General Petroleum Corporation, publicity; L. J. Simon, The Texas Company, exhibits; J. B. Hudson, Monterey Oil Company, finance; E. H. Rader, Standard Oil Company, housing and hotels; J. C. Kimble, reception; L. H. Metzner, technical services; K. L. Rathbun, registration, and H. J. Steiny, transportation.

AIME Announces Election Of Officers and Directors

The American Institute of Mining, Metallurgical and Petroleum Engineers has announced the election of officers and directors to be installed Feb. 18, 1958, at the annual AIME meeting in New York.

Dr. Augustus B. Kinzel, vice president of Union Carbide Corp., New York, and now president-elect of AIME, will become president for one year, succeeding Grover J. Holt, of Ishpeming, Mich., assistant to the president of The Cleveland Cliffs Iron Co. Howard C. Pyle, of Los Angeles, president of the Monterey Oil Co., will become AIME president-elect for 1958, a step toward the presidency in 1959. Two vice presidents will take office for one year: Arthur W. Thornton, of Pittsburgh, assistant to vice president operations, National Tube Division, U. S. Steel Corp., and John C. Kinnear, Jr., McGill, Nev., general manager, Nevada Mines division, Kennecott Copper Corp. Kinnear also will be installed as a director for three years.

Others to become directors for three years are John P. Hammond, Tulsa, assistant general superintendent, Production department, Amerada Petroleum Corp., Walter E. Hibbard, Jr., Schenectady, N. Y., manager, Alloy Studies Research, General Electric Co. research laboratory; Elmer A. Jones, Bonne Terre, Mo., division manager, St. Joseph Lead Co., Basil P. Kantzer, Houston, Union Oil Co. of California; Stanley D. Michaelson, Salt Lake City, chief engineer, Western Mining division, Kennecott Copper Corp.



Separation of shale and abrasives from drilling muds is an important *must* for an effective, time-conserving, money-saving drilling job. Reclamation of mud is vitally important. No matter what the mud flow or well depth may be, a THOMPSON Vibrating Shale Separator and Sample Machine stands up to meet any demand. It's field proven! *You get clean mud.* THOMPSON Separators are self-motivated... making tools last longer... with a minimum of re-tooling and restoration of mud solution.

A THOMPSON Separator is your surest bet.. for shallow, medium and deep wells. The dependable Sample Machine works simultaneously with the Separator, giving a foot-by-foot mud analysis with specimens. *Write for Free Folder.*

THOMPSON TOOL CO.
IOWA PARK, TEXAS

SOLD ONLY THROUGH SUPPLY STORES

Dr. Raymond C. Moore Is New President of GSA

Dr. Raymond C. Moore of Kansas was elected president of the Geological Society of America. Outgoing president Dr. Richard J. Russel, head of the Geology department at Louisiana State University, remains an officer of the Society in the capacity of councilor.

Dr. R. C. Moore

Dr. Moore has served for many years as head of the Department of Geology, University of Kansas. He has long been associated with the State Geological Survey in Kansas and at the University. In 1949 he served as a consultant to General Douglas MacArthur in Japan.

Record-Attending IOCC Elects Simpson Chairman

Governor Milward L. Simpson of Wyoming recently was elected chairman of the Interstate Oil Compact Commission at the final session of the IOCC's largest annual meeting ever held.

The Wyoming governor will serve during 1958, succeeding Governor Raymond Gary of Oklahoma, who presided at the three-day meeting in the Mayo Hotel in Tulsa. The meeting has attracted about 550 persons.

Other officers elected at this morning's session included:

First vice chairman, Jake Jacobsen, the IOCC official representative from Texas; second vice chairman, James C. Hamill, IOCC official representative from Oklahoma; and Earl Foster of Oklahoma City, re-elected executive secretary.

COMPANIES in the News

SHELL OIL COMPANY and **CONTINENTAL OIL COMPANY** signed a contract recently providing a bonus of $11,100,000 for the right to drill for offshore oil with the City Council of Hermosa Beach, Calif. The contract gives the oil companies the right to drill in the city's submerged lands and the use of a tract of city property for operational headquarters and separation center. Hermosa Beach, located on the southern California coast, is one of nearly 100 California cities acting as trustee for submerged lands.

According to the contract, all drilling must be done at sea from four drilling platforms, with all but one of the platforms to be located at least one mile from shore. One platform may be located at the three-quarter mile mark at the southern boundary of the offshore tract. The contract contains stringent anti-pollution and nuisance clauses. Offshore lands owned by the adjacent city of Redondo Beach are presently being developed by slant drilling from the Redondo shore.

•

STANDARD OIL COMPANY OF CALIFORNIA recently installed the largest commercially available electronic computer to solve many "down-to-earth" oil industry problems. Installed in the company's San Francisco headquarters, the unit is one of the highest capacity computers available and is the first to be used in the petroleum industry. It is a technical problem machine, as contrasted with the data counting type machine more commonly used for routine accounting, billing and payroll work. Standard operates the machine on a lease basis of one shift per day, five days per week, at $430,000 per year. The company will do its own programming. As its staff is expanded and new and enlarged uses develop for the machine, it is expected that operation of the unit will be stepped up ultimately to two and even three shifts per day.

•

GULF OIL CORPORATION dedicated its new aluminum and glass office building in Philadelphia, Penn., recently. According to **Wenley D. Nelson,** general manager of Gulf's Philadelphia Sales division, the corporation's new division headquarters were designed to achieve the basic requirements of efficiently housing expanding operations, adding an eye-pleasing structure to the community skyline, and insuring comfortable working conditions for company employes.

•

COMMONWEALTH OIL COMPANY of Houston has acquired reserves estimated at 375,000 barrels in the West Ganado field of Texas through a merger of **Tidelands Oil Company** into Commonwealth. The transaction was approved by Tidelands stockholders at a meeting December 18 in the firm's offices in the Texas National Bank in Houston and by Commonwealth stockholders December 10 at a meeting in Miami. Terms of the merger call for the exchange of nine shares of Tidelands stock for each share of Commonwealth stock. The merged corporation will be known as Commonwealth Oil Company, and the Commonwealth officers and directors will manage the company.

•

PETTY GEOPHYSICAL ENGINEERING CO. has established two company scholarships, to be awarded students following a scientific course of study. The Petty scholarships, which were set up to further the development of geophysical research, will be administered by the Society of Exploration Geophysicists. Both men and women will be eligible to receive the scholarships. Students considered most deserving will be selected by an S.E.G. Committee.

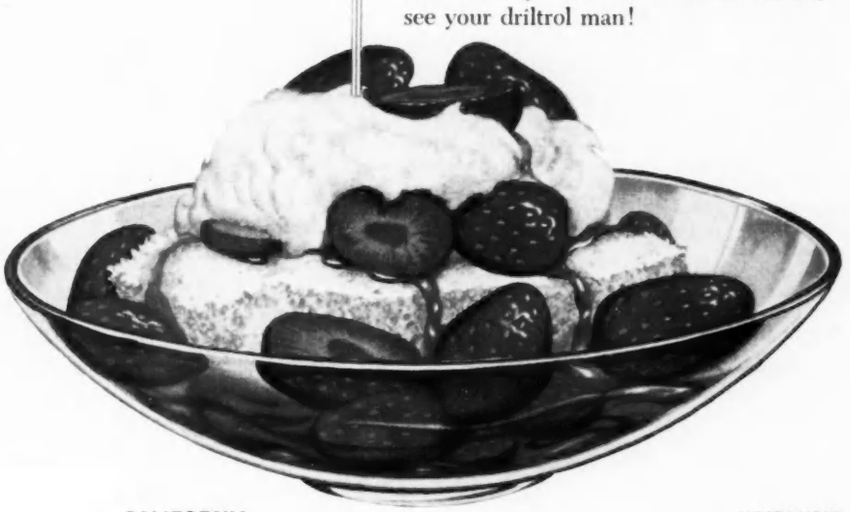
Fastest WAY TO PAYOFF
in anything but strawberry shortcake

Unless your job is the "berries," there is a way to speed drilling.

With driltrol drillable wing stabilizers you can put more weight on the bit for faster, controlled penetration. And, if washover is necessary, you count the time in *minutes* instead of hours! Even the *easy* jobs go faster with driltrol!

More than 25,000 of these stabilizers have *speeded* drilling all over the globe; *controlled* drilling as fulcrums, hole straighteners, key seat guides, and preventatives for pressure differential sticking. Sized to fit your job, priced at about half the cost of a single drill bit!

Unless every inch is a "shortcake cinch," see your driltrol man!



CALIFORNIA
Ventura — MI 3-4366
Long Beach — GA 4-0461
Bakersfield — FA 5-6608
TEXAS
Houston — OL 4-4871
Dickinson — 8-4421
OKLAHOMA
Oklahoma City — ME 7-3325
CANADA
Edmonton — 390-223, 3-6160
Calgary — AM 2-5331
CH 3-6651
WYOMING
Casper — 3-3360
LOUISIANA
Lafayette — CE 4-2137
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What's Happening among SERVICE and SUPPLY MEN

John H. Zauner

R. W. Keener

R. W. Keener and **John H. Zauner** were elected vice presidents of **Lane-Wells Company,** one of the Dresser Industries. Keener has been associated with service company operations for more than 16 years. One of the original partners of the Petro-Tech organization in Venezuela, he resigned as vice president of that company to return to the U. S. at the end of 1955. Recently he has been coordinator of foreign sales-service for Lane-Wells. Zauner, recently technical assistant to the president of Lane-Wells, was formerly operating staff assistant for Dresser Industries, Inc., Dallas. He has held management engineering positions in several companies in the U. S. and South America in the past 20 years. In addition to his duties as vice president, Zauner will be technical director in charge of all engineering and research activities for Lane-Wells.

•

George Connor has been named vice president and operations manager of the **Milwhite Mud Sales Company.** As operations manager, Connor will supervise Milwhite operations in the Gulf Coast, Mid-Continent and Rocky Mountain regions and Canada. Connor joined Milwhite in 1954 as sales manager, after having been with Garrett Oil Tools, Inc. Last year he was promoted to vice president in charge of sales at the company's general offices in Houston.

George Connor

•

Houston Oil Field Material Company, Inc., announced the following transfers and promotions. **B. J. Breeden,** from Oklahoma City to service sales representative, Houston. **H. D. Dawson,** from directional drilling, Ventura, Calif., to directional drilling, Maracaibo, Venezuela, S. A. **Wm. H. Dodson, Jr.,** from sales, Lovington, N. M., to sales, Kimball, Neb. **Wm. B. Hackett** from maintenance to assistant manager of field maintenance, Houston. **Jack B. Hallonquist,** to assistant store manager, Liberty, Texas. **Jimmy R. Keyes,** from Houston, to fishing tool export, Maracaibo. **A. R. King,** from Houston, to store manager, Pearsall, Texas. **C. L. Littlepage,** from warehouse manager, Houston, to sales and service representative, Houston. **C. L. (Hal) Roach,** from Rocky Mountain area manager to executive vice president, Oil Equipment, Ltd., Canada. **Jerry G. Romine,** to store manager, Lovington. **Rayford L. Sewell,** from Morgan City, La., to Brookhaven, Miss. **Dillard L. Thomas,** from sales, Freer, Texas, to sales, Kenedy, Texas.

•

Horace J. Shumate has been named manager of the newly-opened foreign contracting office of **Loffland Brothers Company** at 45 Rockefeller Plaza, New York City.

•

George R. Day was appointed field representative at Estevan, Sask., Canada, for the Oil Well Supply Division of **United States Steel Corporation.** He was employed by Oilwell in 1956 at Estevan.

•

Schlumberger Well Surveying Corporation has announced four new sales engineering assignments. **R. L. Smith** is now sales engineer at Corpus Christi, Texas. Assigned to Gretna, La., is sales engineer **C. R. Perry. M. J. Broussard** is now sales engineer in the Louisiana Gulf Coast division at Lafayette, La., and **C. B. Dennis** is serving as a sales engineer in Houma, La.

•

Joseph J. Lawnick, assistant chief petroleum engineer, La Gloria Oil and Gas Company, has resigned to become drilling and production superintendent, **American Petrofina, Inc.,** Corpus Christi, Texas. Prior to joining La Gloria, he was with Shell Oil Company.

•

Jack L. Thompson has joined the Hydraulic Sales department of the **Axelson Manufacturing Company,** division of U. S. Industries, Inc. Thompson will serve as sales representative in the Permian Basin and Lousiana, representing the complete Hydrax line of Axelson hydraulic pumping units. He has had over ten years' experience in oil field production, both in surface and subsurface equipment. Prior to joining Axelson, he was district specialist in the Production division of Emsco Manufacturing Company.

•

Robert W. Graham has been named systems sales engineer for **Midwestern Instruments, Inc.** Prior to joining Midwestern Instruments, he served as manager in the Data Processing Equipment Engineering Operation of the General Electric Company. His experience also includes more than eight years in supervisory engineering work and the design, development and manufacture of electronic equipment. While with General Electric, Graham was assigned the responsibility of designing, procuring, installing and operating a complete data processing installation for two projects of the ballistic missile program of the department. Graham's duties at Midwestern Instruments will be to receive and develop customers' requirements on new products, systems engineering of complete instrumentation complexes and new design concepts.

Robert W. Graham

•

Victaulic Company of America announced the appointment of **M. R. (Mike) Huffman** to the post of Mid-Continent sales manager. Formerly manager of Victaulic's Odessa, Texas, warehouse-office, Huffman will soon relocate to Tulsa, from which point he will also service Victaulic accounts in the Oklahoma-Kansas area. Huffman's place in Odessa will be assigned to **Ray F. Smith,** who has been covering the West Texas-New Mexico district for Victaulic since 1955. A new Victaulic sales engineer, **Allen H. Leibee,** has been employed to assist Smith in the West Texas district. Leibee has had extensive experience with a major oil producer as well as with equipment manufacturers. On the West Coast **Fred A. Anger** has been employed to assist **H. Dave Squibb,** manager of Victaulic's Los Angeles branch. Anger has had more than ten years experience in the oil and other industries, as assistant marketing manager with Howard Supply Company.

•

Fred M. Butler was elected a director of **Cities Service Oil Co. (Del.).** Butler is manager of Cities Service Oil Co.'s Industrial Relations division and has been active in industrial and personnel relations work for the company since 1930. He was named industrial relations manager in 1941.

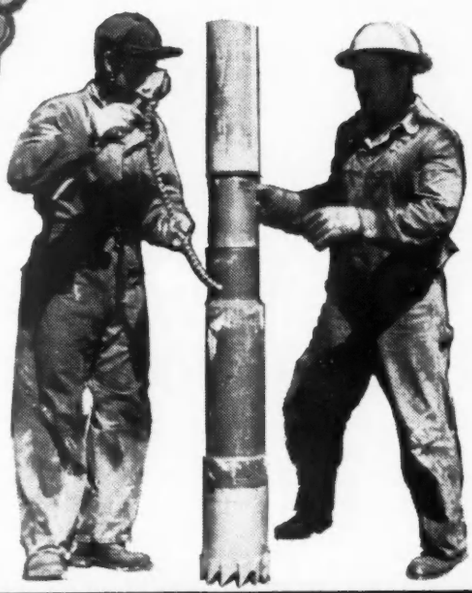
•

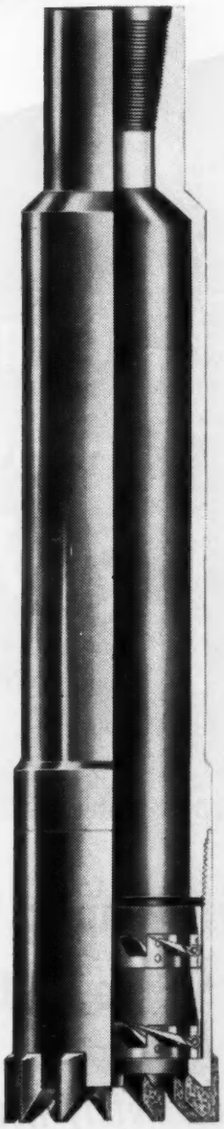
Baroid Division National Lead Company has announced several significant appointments and transfers in its Louisiana operations. **C. W. Felker,** who was formerly

For all emergency jobs

. . . it never fails to minimize losses due to junk recovery problems. The very simplicity of design in the Globe Junk Catcher holds the answer to its consistently efficient performance. With this tool on your fishing string, you can reach down to break up and bring up all types, sizes and shapes to nearly full hole size. Operators report that in most instances they obtain 100% recoveries on every run.

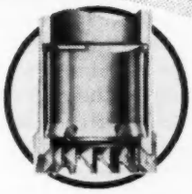
GLOBE Junk Catcher





Shown here is the dog type catcher. Easily interchanged with the Magnet type catcher.

Operators now require only one outfit, complete with both types of catchers, for all junk recoveries.



MAGNET TYPE CATCHER

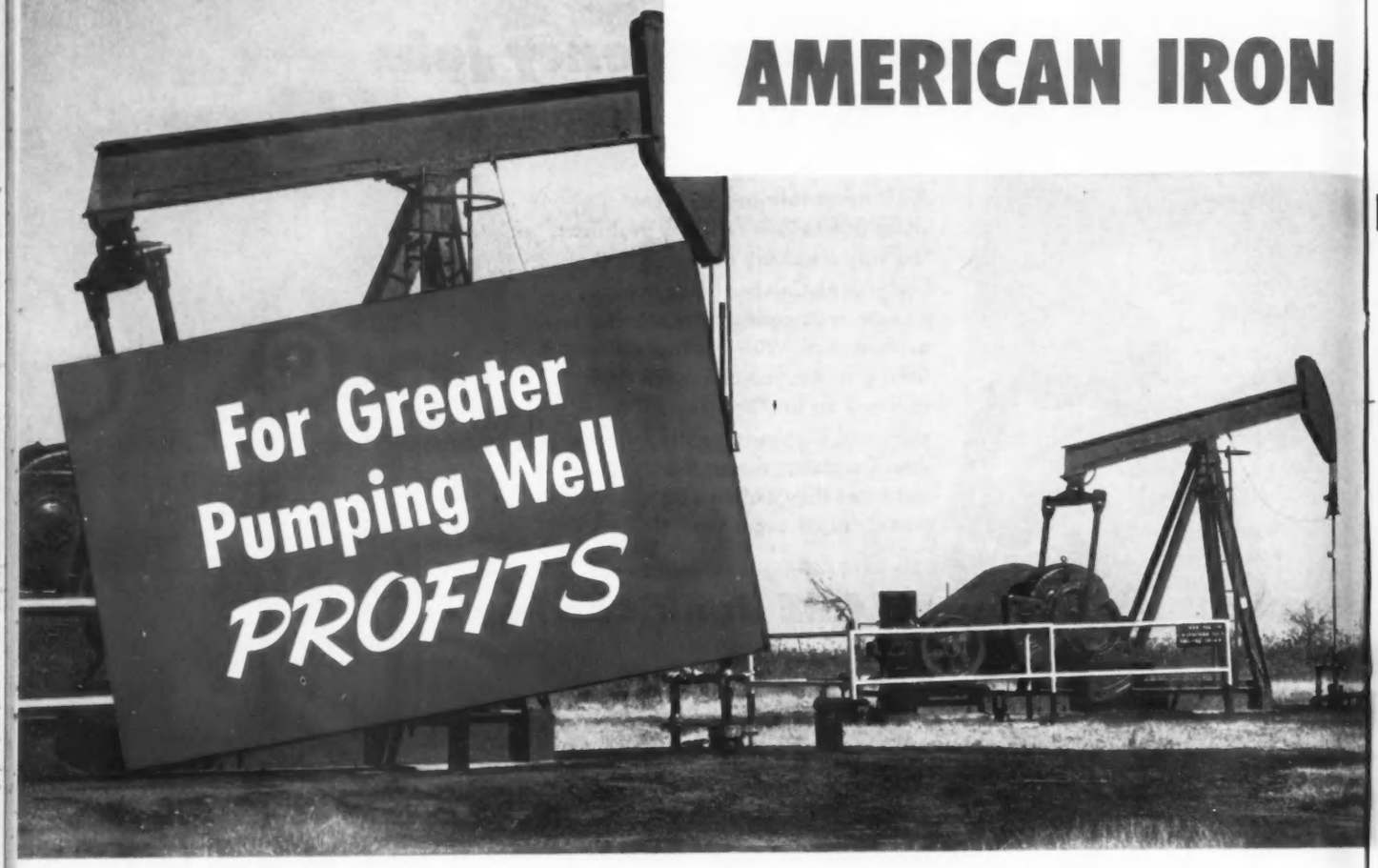
GLOBE
OIL WELL DRILLING TOOLS

GLOBE OIL TOOLS CO.

Main Office and Plant: LOS NIETOS, CALIFORNIA

Branches In All Principal Drilling Areas Are Serving The Petroleum Industry With Field Engineered Drilling Equipment

AMERICAN IRON



Your Pumping Wells Become More Profitable when you install the AMERICAN IRON *NEW* TENSION TUBING ANCHOR

Completely Retrievable Under All Conditions:

Under normal conditions, just re-jay and pull. Tubing anchor will retrieve easily. Under adverse conditions, a steady upward pull on the tubing will cause a tensile failure of the relief groove in the slip mandrel extension. The upper portion of the slip mandrel extension then becomes a jar that strikes the inside shoulder at the upper end of the housing. The slips are pulled away from the cone and the tool can be retrieved.

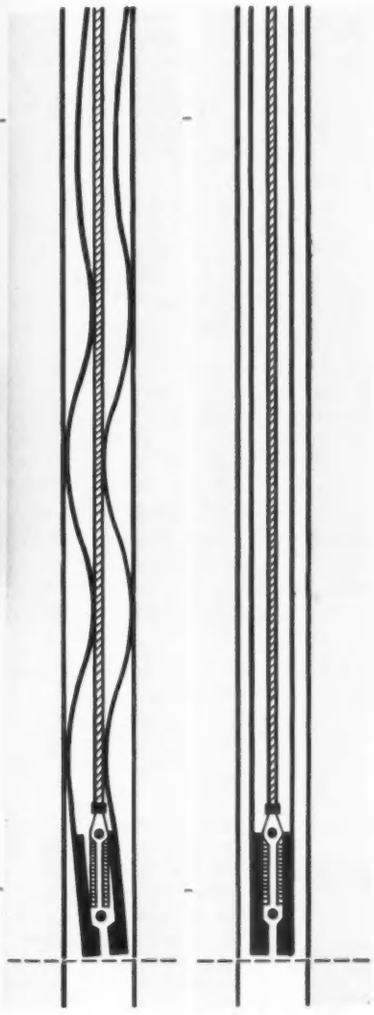
MONEY-SAVING ADVANTAGES listed below show how the American Iron new tubing anchor helps you get maximum pumping well profits!

- **Increases service-life of rods and tubing!**
- **Increases fatigue-life of tubing!**
- **Increases efficiency of the pump!**
- **Decreases tubing connection wear!**
- **Decreases rod-on-tubing wear!**
- **Decreases horsepower input requirements!**
- **May be used as Automatic Tension Tubing Anchor, Positive Tension Tubing Anchor!**

35 YEARS' EXPERIENCE ENABLES AMERICAN IRON & MACHINE WORKS CO.

NEW TENSION TUBING ANCHOR

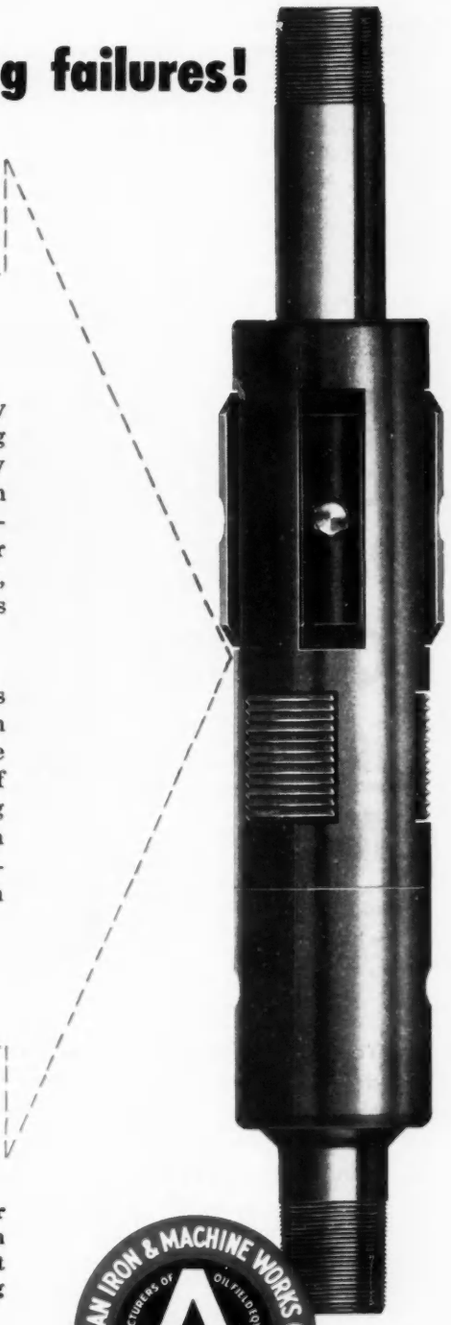
prevents costly sucker rod and tubing failures!



(left)—FREELY SUSPENDED TUBING buckles on the upstroke and *(right)* straightens on the down stroke.

IN PUMPING WELLS, the costly buckling, breathing and cork-screwing of tubing can now be prevented by keeping pumping strings in tension with the American Iron Tension Tubing Anchor. Once this tubing anchor is set, all movement of the tubing, either upward or downward, is eliminated!

FREELY SUSPENDED TUBING buckles on the upstroke . . . and straightens on the downstroke. This damaging cycle can now be prevented by the use of the new American Iron Tension Tubing Anchor—created through American Iron research and design . . . and manufactured under American Iron high quality control standards.



Get all the details now—from your Supply Store or your American Iron representative . . . get the facts that will lead you to greater pumping well profits!

Contact your Supply Store now!

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PETROLEUM EQUIPMENT

AMERICAN IRON & MACHINE WORKS COMPANY, INC.
518 North Indiana Avenue • Oklahoma City, Oklahoma
Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY

AMERICAN IRON & MACHINE WORKS CO., INC. — MANUFACTURERS OF OIL FIELD EQUIPMENT — OKLAHOMA CITY

TO PROVIDE YOU WITH THE FINEST OF DRILLING AND PRODUCTION TOOLS!

superintendent of the Southwest Louisiana district, has transferred to New Orleans as assistant manager of Louisiana Baroid Sales. **F. D. Franklin, Jr.,** has been appointed sales representative of Louisiana Baroid Sales with headquarters in New Orleans. **Paul A. Newton,** formerly sales representative at Lafayette, La., has now assumed his duties as manager of the Louisiana Baroid Sales district. **R. T. Sutton,** formerly superintendent of the North Louisiana and Arkansas district, has been appointed superintendent of the Southwest Louisiana district at Lake Charles. Replacing him as superintendent of the North Louisiana and Arkansas district is **Arlen E. Milligan,** formerly sales representative. **J. M. Humble,** who previously was sales representative in the Texas Gulf Coast area at Houston, has been appointed superintendent of South Central Louisiana at Lafayette. **E. H. Hearn,** formerly service engineer, has been appointed sales representative at Shreveport, and Service Engineer **S. E. Marrs** has been appointed sales representative at Lafayette.

•

Cardwell Manufacturing Company announced the appointment of **Willis L. Chase** as district sales representative for the Rocky Mountain area. For the last three years, he was sales representative for Meredith G.M.C. Trucks in Casper, Wyo. He held the position of district manager for Buda Engine Sales and Service in Casper, for a ten-year period.

You'll win more than this prize. You'll increase drilling efficiency and control your mud better. Mud-O-Graf records every variation in mud weight, saving time and costly errors in the addition of weighting materials. All heavy and light streaks in the circulating system and their duration are recorded. Mud-O-Graf shows how often the hole is filled up when coming out of the hole and shows the time of a complete circulation. If it's a question of mud, ask for Mud-O-Graf.

WARREN AUTOMATIC TOOL CO.

Manufacturers of Pit-O-Graf and Rig Runner.

3915 Tharp St. Houston CApitol 4-2511

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Glenlyn H. Blackburn has been appointed foundry manager for **W-K-M, Division of ACF Industries Incorporated.** Blackburn, who will be responsible for all operations at the new foundry, came to W-K-M after 22 years with the Walworth Company, Greensburg, Penn., where he was superintendent of foundries for the past five years.

G. H. Blackburn

•

Arthur W. McKinney, president of **The National Supply Company,** has been elected to the board of directors of the Allegheny General Hospital, Pittsburgh, Penn. He fills the vacancy caused by the retirement of **J. Farley Walton,** who is living in Florida.

•

Tretolite Company has announced the appointment of two new assistant division managers. **James W. Hakeman,** formerly senior corrosion engineer for Tretolite at Shreveport, La., has been named assistant to the Rocky Mountain division manager, **L. C. Dessert, Jr.** Hakeman will be located at Edmonton, Alberta, and will be over Western Canada operations. Hakeman was with Halliburton Oil Well Cementing Company before joining Tretolite in 1953 as field service engineer. **James H. Burrell, Jr.,** formerly senior field testing engineer for Tretolite, has been named assistant to **John Hampton,** manager of the West Central division. Since joining the company in 1938, Burrell has worked closely, both in the field and in the laboratory, in the testing and development of new compounds. Burrell will continue to make his headquarters in Midland, Texas.

•

Gerald Seber has been appointed export sales representative for the **Mission Manufacturing Company** with headquarters in Houston. Seber joined Mission 1½ years ago as a field sales representative in the Ark-La-Tex district with offices in Shreveport, La. He held that post until being named export sales representative.

Gerald Seber

•

Seismograph Service Corp. and its subsidiaries, Lorac Service Corp. and Lorac Maritime Corp. have announced transfers of key personnel. **Robert S. Finn,** formerly executive vice president of Lorac Service and Lorac Maritime corporations, has been transferred to SSC as vice president in charge of all domestic exploration divi-

These leading manufacturers, suppliers and service companies have filed complete or condensed catalog data in the current edition of COMPOSITE CATALOG. When you are ready to buy, see their detailed information there.

A-1 Bit & Tool Company
A 3 Products
ACF Industries, Inc., W-K-M
Abegg & Reinhold Co.
Acme Oil Tool Co.
Acme Patent Development Co.
Acme Regulator Co., Inc.
Advance Oil Tool Co.
Aeroquip Corp.
The Aerotec Corp.
Aetna Ball and Roller Bearing Co.
Ajax Iron Works
Alamo Iron Works
Alco Products, Inc.
The Aldrich Pump Co.
Alemite Division of Stewart-Warner Corp.
Allis-Chalmers
Allis-Chalmers, Buda Division
Alten Foundry & Machine Works, Inc.
American Blower Division
American Chain & Cable Co., Inc.
American Coldset Corp.
American Hoist & Derrick Co.
American Iron and Machine Works Co.
American Manufacturing Co. of Texas
American Pipe & Steel Corp.
American Recording Chart Co.
American-Standard, American Blower Division
American Steel & Wire Division, U. S. Steel
George Angus & Co. Ltd.
Athol Machine & Foundry Co.
Audley Engineering Co. Ltd.
Axelson Manufacturing Co.
Aztec Manufacturing Co.
B and W Inc.
Baash-Ross Tool Co.
Baker Oil Tools, Inc.
Barco Manufacturing Co.
Barnes Manufacturing Co.
Baroid Division, National Lead Co.
Baylor Company, Inc.
J. B. Beaird Co., Inc.
Beaver Pipe Tools, Inc.
Beck Engineering Combustion Company
Belt Corp.
Bell & Gossett Co.
Bell Rubber Co.
Bethlehem Steel Co.
Bethlehem Supply Co.
Bettis Corp.
Bettis Rubber Co.
Big Four Machine & Supply Co.
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Bowen-Itco
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Bradford Pipe & Tool Co.
Brakesol, Inc.
The Brewster Co., Inc.
Broderick & Bascom Rope Co.
Harold Brown Co.
Brown Oil Tools, Inc.
Bucyrus-Erie Co.
Buda Division, Allis-Chalmers
Bullum-Inc.
Burt Tank, Separator & Oil Treating
Butler Manufacturing Co.
Byron Jackson Tools, Inc.
Cabot Shops, Inc.
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The Chevins Co.
Celler Machinenfabrik Gebruder Schafer
Chain Belt Co.
Champion Spark Plug Co.
A. B. Chance Co.
Chicago Pneumatic Tool Co.
Chiksan Co.
Christensen Diamond Products Co.
Clark Bros. Co.
Climax Engine & Pump Mfg. Co.
Coffing Hoist Division
Coleman Instrument Co.
Colorado Fuel and Iron Corp.
Commercial Iron Works
Construction Machinery Co.
Continental-Emsco Co.
Continental Motors Corp.
Control Specialty Corp.
Cooper-Bessemer Corp.
Fred E. Cooper, Inc.
Cosasco Division, Perfect Circle Corp.
Creighton Oil Tool Co.
Crosby-Laughlin
Crossett Chemical Co.
Cummins Sales & Service Inc.
DXD Division, Continental-Emsco Co.
Dale Co.
Daniel Orifice Fitting Co.
Davey, Paxman & Co., Ltd.
Denison Engineering Division
Derrick Light & Equipment Co.
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Diamond Bit and Coring Co.
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Diamond Oil Well Drilling Co.
Directo Corp.
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Double Seal Union Co.
Dowell Incorporated
C. H. Dragert, Inc.
Dresser Industries
Drilco Oil Tools, Inc.
Drilling & Service, Inc.
Drilling Equipment Mfg. Co.
Duff-Norton Co.
The Duraflex Co.
Eason & Therolf Co.
Eastman International Co.
Eastman Oil Well Survey Co.
Edward Valves, Inc.
Eidal Manufacturing Co.
Eisenwerk Wulfel
Emsco Screen Pipe Co.
Enardo Manufacturing Co.
English Drilling Equipment Co. Ltd.
Equipment Engineers, Inc.
Eureka Tool Co.
Everstick Anchor Co.
Evis Petro-Fluid Corp.
Exner-Dodge, Inc.
Exploration Equipment Co.
Failing Co.
Fairbanks, Morse & Co.
Falcon Products, Inc.
Fann Instrument Co.
Fawick Airflex Division, Fawick Corp.
Fisher Governor Co.
Flexitallic Gasket Co.
Fluid Packed Pump Co.
Food Machinery & Chemical Corp.
Ford Alexander Corp.
Foster Cathead Co.
Foxboro Co.
Franks Division, Cabot Shops, Inc.
Franks Machine Co.
Fuller Co.
Gadco Products, Inc.
Gammaloy Ltd.
Gardner-Denver Co.
Garrett Oil Tools, Inc.
Garrott Brass and Machine Co., Inc.
Gaso Pump & Burner Mfg. Co.
Gates Rubber Co.
Gearench Mfg. Co.
Gebruder Schafer
General American Transportation Corp.
General Electric Co.
Geolograph Co.
Geotex Co.
Globe Oil Tools Co.
Goodall Rubber Co., Inc.
Gorman-Rupp Co.
H. P. Gott Manufacturing Co.
Grant Oil Tool Co.
Graver Tank & Mfg. Co., Inc.
Gray Tool Co.
Griffin Oil Well Service
Grip-Tite Manufacturing Co.
Grove Valve and Regulator Co.
Guiberson Corp.
Guler Products Manufacturing Co.
Gulf Coast Machine & Supply Co.
Gulf Tool Company, Inc.
Gwilliam Co.
Hacker Machine & Supply Co.
Halliburton Oil Well Cementing Co.
Hamer Valves, Inc.
Hands-England Oilfield Equipment Ltd.
Harbison-Fischer Manufacturing Co.
Hardy-Griffin Engineering Corp.
Harries Sales & Rentals
Harrisburg Sales & Service, Inc.
Herb J. Hawthorne, Inc.
Haynes Stellite Co.
Hayward Testing Service
Hazard Wire Rope Division
Heidle's Machine Works
Heidle's Portable Pipe Service
Hendershot Tool Co.
Hercules Motor Corp.
Hercules Tool Co.
Hewitt-Robins
Hillman-Kelley
Don R. Hinderliter, Inc.
H_2Oil Engineering Corp.
Hollow Rod Sales and Service Co.
Homelite, A Division of Textron Inc.
Hopper Machine Works, Inc.
Charles N. Hough Mfg. Co.
Houston Engineers, Inc.
Houston Export Crating and Construction Co.
Houston Oil Field Material Co., Inc.
Houston Ready-Cut House Co.
Houston Well Screen Co.
Howard-Turner Machine Works
J. M. Huber Corp.
Hughes Tool Co.
Hunt Tool Co.
Hutchison Manufacturing Co.
Hycalog, Inc.
Hydraulic Pump Co.
Hydril Co.
IDECO, One of The Dresser Industries
Indian Drilling Mud Co., Inc.
Ingersoll-Rand Co.
International Harvester Co.
J & J Steel Supply Co.
J. P. Machine and Tool Co.
James Tool Co.
Jensen Brothers Manufacturing Co.
Jet-Lube, Inc.
Johns-Manville
Johnson Block Co.
Johnson-Fagg Engineering Co.
Johnston Testers, Inc.
Jones & Laughlin Steel Corp.
S. M. Jones Co.
Joy Manufacturing Co.
Justrite Manufacturing Co.
K & G Oil Tool and Service Co., Inc.
Ben F. Kelley Co., Inc.
Ken Corporation
Keystone Development Corp.
Keystone Supply Co.
Keystone Valve Corp.
Kimray, Inc.
King Oil Tools
Kingston Instrument Co. Ltd.
M. M. Kinley Co.
Kinzbach Tool Co., Inc.
Kobe, Inc.
L-K Pump Valve Co.
Lamtex Equipment Corp.
Lane-Wells Co.
Langdon Manufacturing Co.
Larkin & Co., Inc.
Larkin Packer Co., Inc.
Layne and Bowler Co.
Lebanon Steel Foundry
LeBus International Engineers, Inc.
LeBus Manufacturing Co.
LeGrand Sutcliff & Gell Ltd.
Leland Hamner Co.
LeRoi Division, Westinghouse
Leschen Wire Rope Division H. K. Porter Co., Inc.
Lewis Manufacturing Co.
Liberty Manufacturing Co.
Line Scale Co., Inc.
Link-Belt Co.
R. A. Lister & Co., Ltd. and Lister-Blackstone Inc.
A. M. Lockett & Co., Ltd.
Lone Star Steel Co.
Lone Star Tool Co.
Jon R. Long Manufacturer
Lowell Wrench Co.
Lubrikup Co., Inc.
Lucey Boiler & Manufacturing Corp.
Lufkin Foundry & Machine Co.
M-C-M Machine Works
M & V Tank Co.
MacClatchie Manufacturing Co.
Macco Oil Tool Co., Inc.
Magnaflux Corp.
Magnet Cove Barium Corp.
Magnetrol Inc.
Maintenance Engineering Corp.
F. H. Maloney Co.
Maloney-Crawford
Mannesmann-Trauzl Aktiengesellschaft
Marine Products Co.
Clayton Mark & Co.
Marlow Pumps
Marman Products Co. Inc.
Marsh Instrument Co.
Martin-Decker Corp.
John N. Martin, Manufacturer
Marvel Engineering Co.
Mason-Neilan
C. A. Mathey Machine Works, Inc.
Mattco, Inc.
Mayhew Supply Co., Inc.
McClinton Tool Co.
McCord Corp.
McCullough Tool Co.
McEvoy Co.
McFarland Engineering & Pump Co.
McFarland Manufacturing Corp.
McGaffey Taylor Corp.
McKissick Products Corp.
Henry Meadows Limited
Medearis Oil Well Supply Corp.
Mercoid Corp.
Merla Tool Corp.
Mexia Tubing Rotator Co.
Mid-Co Hard Banding Co.
Mid-Continent Supply Co
Miller Sand Pump Co.
Mine Safety Appliances Co.
Minneapolis-Moline Co.
Mission Manufacturing Co.
Mixing Equipment Co., Inc.
Monarch Engineering Corp.
Moon Manufacturing Co.
Lee C. Moore Corp.
Morse Chain Co.
Mud Control Laboratories, Inc.
Frank W. Murphy
Murphy Diesel Co.
Murray Rubber Co.
W. C. Nabors Co.
National Lead Co.
National Supply Co.
National Tank Co.
Naylor Pipe Co.
J. B. Nelson
New Deal Specialty Co., Inc.
Newman, Hender & Co., Ltd.
New York Air Brake Co.
New York Belting & Packing Co.
Niagara Screens (Great Britain) Ltd.
Nordberg Mfg. Co.
Nordstrom Valve Division
W. C. Norris, Manufacturer, Inc.
O & M Manufacturing Co.
Walter O'Bannon Companies
Odex Engineering Co.
Oil Center Tool Co.
Oil Country Equipment Co., Inc.
Oilfield Machine & Supply Co.
Oil Metering and Processing Equipment Co.
Oil States Rubber Co.
Oil Tool Manufacturing Co.
Oil Well Manufacturing Corp.
Oil Well Supply Division
D. W. Onan & Sons Inc.
Orbit Valve Co.
Oster Manufacturing Co.
Otis Pressure Control, Inc.
Overstrom & Sons
P & S Engineering Co.
Pacific Pumps
Page Oil Tools, Inc.
Paramount Equipment Co., Inc.
Parkersburg-Aetna Corp.
Parkersburg Rig & Reel Co.
Partlow Corp.
Patterson Steel Co.
Paxman, Davey & Co., Ltd.
Payne Manufacturing Co.
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Peerless Pump Division
Perfect Circle Corp.
Perforating Guns Atlas Corp.
Petroleum Equipment Co. Ltd.
Petroleum Instrument Co.
Petroleum Machine Co.
Petroleum Mechanical Development Co.
Petroleum Specialty Co., Inc.
Petrolite Corp., Tretolite Co. Division
Piling & Construction Co Ltd.
Pioneer Specialties, Inc.
Pittsburgh-Des Moines Steel Co.
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Pittsburgh Steel Co.
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Port Houston Iron Works, Inc.
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Reda Pump Co.
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Regan Forge & Engineering Co.
Sid Richardson Development Co.
"Rig-A-Lite" Co.
Rig Engineers & Fabricators Co., Inc.
Robinson Orifice Fitting Co.
Rockford Clutch Division
Rockwell Manufacturing Co.
Rolls-Royce Limited, Oil Engine Division
Rollway Bearing Co., Inc.
Rolo Manufacturing Co.
Rotary Oil Tool Co.
Ruston & Hornsby Ltd.
S & R Tool and Supply Co.
Salt Water Control, Inc.
Sargent Engineering Corp.
Saunders Brothers
Schlumberger Well Surveying Corp.
Schoeller-Bleckmann Steelworks Ltd.
Schramm, Inc.
Security Engineering
Sentinel Manufacturing Co.
Servco Co.
Shaffer Tool Works
Sillers Engineering Division
Simplex Jack Division
M. B. Skinner Co.
Skinner Brothers Co.
H. C. Smith Oil Tool Co.
Howard Smith Co.
Tyson Smith Co.
Snelling Manufacturing, Inc.
S.N.M.A.R.E.P.
Societe de Fabrication de Material de Forage
Southern Mill & Manufacturing Co.
Southwest Oilfield Products, Inc.
Spang & Co.
Spencer-Safford Loadcraft Inc.
Sperry-Sun Well Surveying Co.
Standco Brake Lining Co.
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Stewart & Stevenson Services, Inc.
Stewart-Warner Corp.
Stewarts and Lloyds Ltd.
Joe Stine Inc.
Stone Instrument and Supply Co.
Stratoflex, Inc.
Sunset Engineering and Supply Co.
Sunshine Iron Works
Sweet Oil Well Equipment, Inc.
S. G. Taylor Chain Co., Inc.
Taylor Instrument Companies
Technical Oil Tool Corp.
Templeton, Kenly & Co.
Texas Creosoting Co.
Texas Flange Co.
Texas Gulf Tank Co.
Texas Iron Works, Inc.
Texas Tool & Machine Co., Inc.
Texsteam Corp.
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Thornhill-Craver Co.
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Toledo Pipe Threading Machine Co.
Tretolite Co.
Tripplehorn Co.
Tri-State Oil Tool Co.
Tuboscope Co.
Tubular Lining Corp.
Tulsa Winch
Turbolite Co.
20th Century Manufacturing
Twin Disc Clutch Co.
U. S. Industries, Inc.
Unibolt Division, Thornhill-Craver Co.
Union Carbide and Carbon Corp.
Union Chain and Manufacturing Co.
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United States Motors Corp.
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Universal Atlas Cement Co.
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Weatherford Oil Tool Co.
Weil Controls, Inc.
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Wilson Manufacturing Co.
Web Wilson Oil Tools, Inc.
Wilson Supply Co.
Winter-Weiss Co.
Win-Well Manufacturing Co.
Alfred Wirth & Co.
Wisconsin Motor Corp.
Witte Engine Works
Woodfield Hoist & Associated Industries Ltd.
Woolley Tool Co.
Worthington Corp.
Yale Machine Works
Youngstown Sheet & Tube Co.
Yowell Service Co.

sions, including northern and southern seismic divisions, the continuous velocity logging division, gravity operations and the seismic relay center. **J. W. Hammond,** who formerly handled field operations and liaison between research, manufacturing and supply divisions, has been appointed staff supervisor for foreign operations. **C. E. McClure,** vice president, has been appointed manager of Lorac Service Corp. for all petroleum industry applications, including foreign work and any activities outside the Gulf of Mexico in the petroleum field. McClure also will become manager of Lorac Maritime Corp., assuming the duties formerly held by Finn. **Clyde V. Hussey** has been appointed manager of all Lorac applications that are not tied directly to the petroleum industry. **D. J. Kartman** has been placed in charge of liaison between field operations and the Research Manufacturing and Supply division.

•

Frank W. Jenks, formerly executive vice president, **International Harvester Company,** was elected president of the company. Jenks succeeds **Peter V. Moulder,** who retired as president and who also resigned from the board of directors. Jenks began his Harvester career as a clerk in the Richmond, Va., sales office in 1914. He came to the General office in Chicago in 1928, and in 1930 was appointed assistant regional sales manager. He was elected vice president, merchandising services, in 1944, and elected executive vice president in May, 1956. He has been a member of the board of directors since 1952.

•

T. R. Fullinwider was appointed domestic sales manager for the **Mission Manufacturing Company.** Mission recently has merged the Centrifugal Pump Sales division with the Domestic Oil Field Sales division, and in this new post, Fullinwider will direct the overall domestic sales effort. He has been associated with Mission for ten years. He was domestic oil field sales manager prior to receiving his new assignment.

T. R. Fullinwider

New Rockwell Valve Plant Goes Into Production at Kearney, Neb.

Rockwell Manufacturing Company's new 180,000-square-foot plant at Kearney, Neb., is now in limited production.

Approximately 75 employes are already at work in the new plant, which manufactures Rockwell-Nordstrom lubricated plug valves for the petroleum, natural gas, chemical and other fluid-producing and fluid-using industries.

The new plant, which cost more than $2 million, is a one-story brick and tile structure located on a 52-acre plot. Valves will be completely machined, assembled and tested there.

Five Men Named Members Of National Defense Reserve

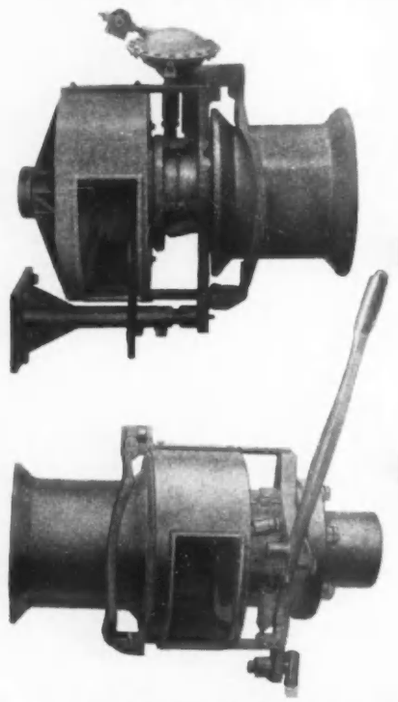
Five men in the petroleum industry's fields of equipment manufacturing supply and service have been certified as members of the "National Defense Executive Reserve," a voluntary organization which will cooperate with the Business and Defense Services Administration of the Department of Commerce in the allocation of strategic materials to the oil industry during an emergency.

They are: Gordon Clarke, Los Angeles, Hughes Tool Company; Howard M. Drake, Dallas, Oilwell Supply Company; George E. Oller, Jr., Parkersburg, W. Va., Parkersburg Rig & Reel Company; Earl R. Cobden, Houston, Hughes Tool Company, and Walter K. Graham, Milwaukee, Harnischfeger Corporation.

These "Executive Reservists" are in the so-called ACMO Division, which is one of 25 divisions representing various American industries under the Business and Defense Services Administration reserve plan. ACMO stands for agriculture, construction mining and oil field. Division activity concerns equipment, rather than operation of the industries. ACMO director is John F. Skillman.

The Executive Reserve is part of the emergency planning being done by the Department of Commerce in Washington. In the event of an emergency, the Government would call this Reserve to help set up and operate an agency similar to

SPECIFY FOSTER CATHEADS WHEN ORDERING YOUR NEW DRAWWORKS



The PAIR That Made Foster Famous

FOSTER TYPE 33 BREAKOUT CATHEAD
12 in. Cathead Spool
18 in. Clutch
Direct Shaft Mounting

FOSTER TYPE 15 SPINNING CATHEAD
12 in. Cathead Spool
18 in. Clutch
Hub Mounting

Thousands of these famous catheads are in use throughout the world. They are the world's finest, with such features as:

• Smooth, powerful pull, assured by an outstanding single-plate friction clutch • Instant engagement without shock or impact • Instant disengagement by release of the cathead controls • Drum mounted on a stationary sleeve, eliminating the need for a complicated brake.

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All Foster Representatives carry a complete inventory of spare parts for Foster tongs and all models of Foster Catheads.

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Peck Sales & Service ..... Houston, Texas
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R. D. Cloninger ..... Lafayette, Louisiana
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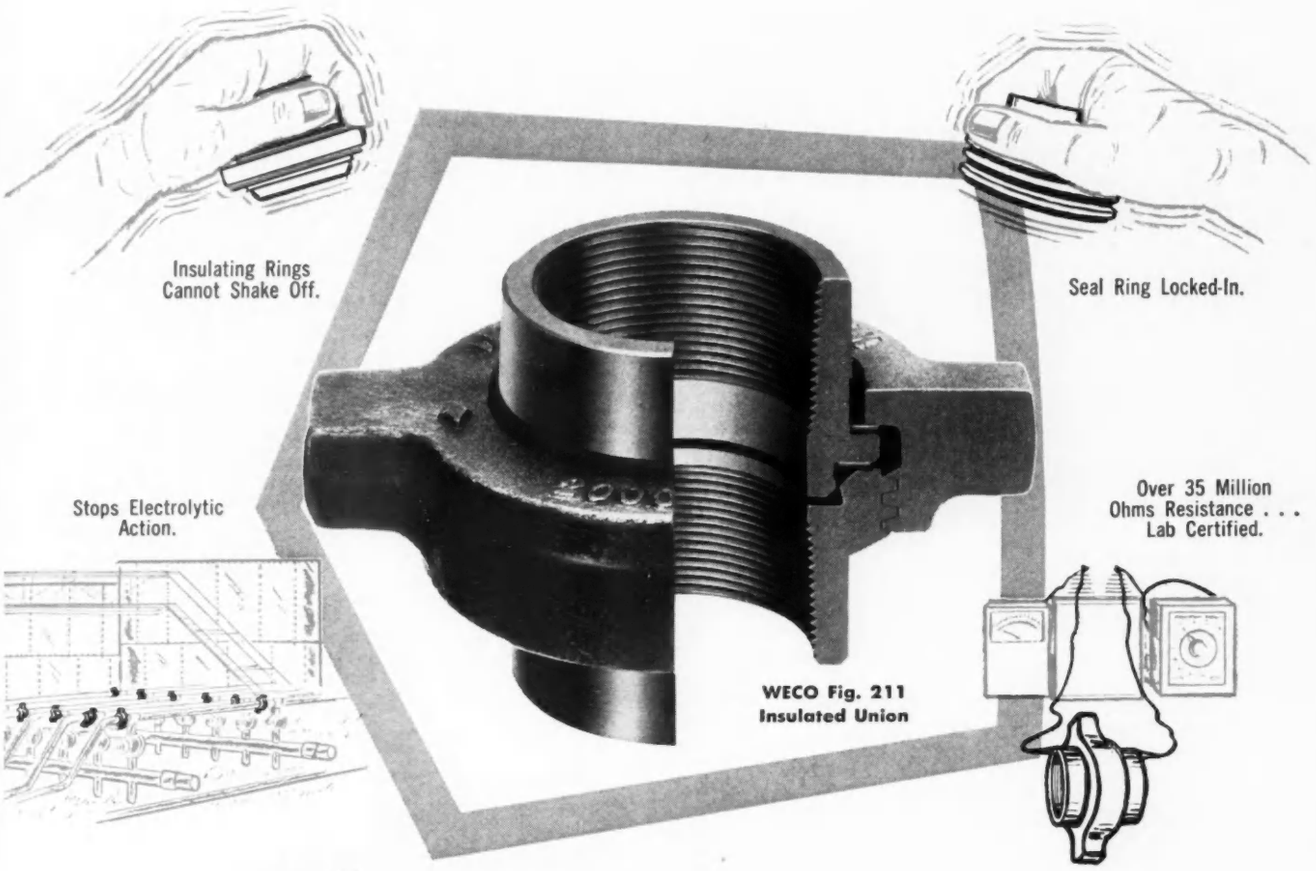
W. O. Nelson ..... Farmington, New Mexico
Coastal Engineering Co. .... Bakersfield, California
Moore Sales & Service Company Casper, Wyoming
Joe Perry ..... Salem, Illinois
T. C. McDonald ..... Shreveport, La.
Leidecker Tool Co. Ltd. Edmonton, Alberta, Canada
Langley Y Cia Srl ..... Buenos Aires, Argentina
East-West Oil Tools C. A. Maracaibo & Anaco, Venezuela



NEW! WECO INSULATED UNION WITH LOCKED-IN INSULATION

Proved practical and reliable in one year's field testing, WECO Insulated Unions have been laboratory certified to provide more than 35 million ohms resistance across the union to stop electrolytic action on fittings and pipes. Insulating rings are locked-in to stay-put during handling and make-up so your crew loses no time picking up lost insulation material or holding it in place.

The special laminated insulating rings and tough rubber seals operate at temperatures up to 350° F.

And these WECO Insulated Unions can take it, the same as any WECO Union. Even after hundreds of make-up and break-out cycles they still seal for long economical service.

Insist on WECO Insulated Unions . . . available in sizes 1″ through 4″, for pressures up to 2000 psi . . . stocked by supply stores everywhere.

U-1-58

WECO®

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

Division of CHIKSAN COMPANY *a subsidiary of*
FOOD MACHINERY AND CHEMICAL CORPORATION

the PAW in World War II and the PAD during the Korean action.

Bovaird Opens New Store At Farmington, New Mexico

Opening its second new store in as many months, the Bovaird Supply Company has named Joe Smith as manager of its Farmington, N. M. store.

Joe Smith

This new style standard store has just been completed and is now entirely stocked to meet the needs of drilling and production in the Four Corners area.

Smith, with ten years experience in the oil field supply business, has been with the Bovaird Supply Company for six years. The Farmington store is located at 5505 East Main St.

National Association Planned For Rock Bit Manufacturers

Plans are underway now for formation of a National Association of Rock Bit Manufacturers, Joe Cowan, Fort Worth advertising executive, has announced.

Cowan, who has had ten years experience in sales promotion and advertising for rock bit manufacturers, in announcing the plans said: "Serious problems are confronting the rock bit manufacturers today that can be eliminated by cooperative efforts on an industry-wide basis."

After consulting with several major manufacturers who expressed a need for such an organization, the following objectives were announced: (1) develop a well planned public relations program for the industry, (2) provide central organization for technical and industry-wide information, (3) develop sales aids and helps for better merchandising techniques, (4) develop publicity on members of the Association.

R. G. Taylor to Coordinate Special BJ Tools Group

Byron Jackson Tools, Inc., has set up a special research and development group within its Engineering department.

The new group is under the general direction of Ray G. Taylor, Jr., manager of oilfield products engineering, and is headed by Simon Tamny, supervisor of research and development.

The new group does not concern itself with standard assembly line tools, but concentrates on basic drilling problems. This special research and development staff has access to all engineering and laboratory facilities of Byron Jackson as well as being able to draw upon the facilities and experience of the Research Center of the Borg-Warner Corporation, Byron Jackson's parent company.

SSC Buys Five Mobile Units For North African Operations

Expansion of operations in North Africa, and the purchase of five air conditioned mobile units to serve the SSC crews there have been announced. SSC has purchased the mobile units from Spartan Trailers, Inc., Tulsa. The units will provide air conditioned crew kitchen, machine shop, dining quarters and office for the crew, which will operate out of Tripoli, the Libyan capital.

Area manager for the Libyan operation will be W. W. Green, with C. E. Warnaca as party chief.

Waukesha Motor Company Buys Climax Engine Manufacturing Co.

The Waukesha Motor Company has announced its outright purchase of the complete plant and assets of the Climax Engine Manufacturing Company of Clinton, Iowa, manufacturers of internal combustion engines. The purchase price was not disclosed.

Waukesha's present manufacturing facilities occupy 20 acres of floor area and employs about 1650 people. The acquisition of the Climax Company, with approximately 200 employes, adds 160,000 square feet of engine manufacturing space and an iron foundry. The Waukesha plant site covers 55 acres, and the Clinton plant site covers nearly 11 acres.

Grant Oil Tool Company Obtains Zublin Manufacturing Line

Grant Oil Tool Company has announced the acquisition of the Zublin line of drilling tools. Grant has obtained all patents and manufacturing rights for Zublin differential bits, simplex bits and drainhole equipment.

The VIKING
GEAR-WITHIN-A-GEAR
Rotary Pumping Principle

. . . operates equally well in either direction.

. . . for all grit-free liquids.

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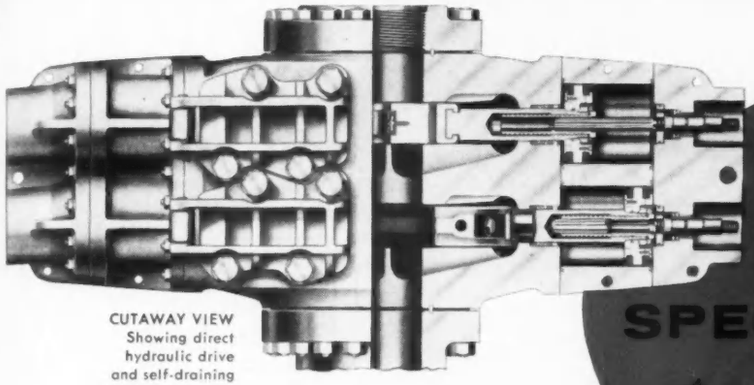
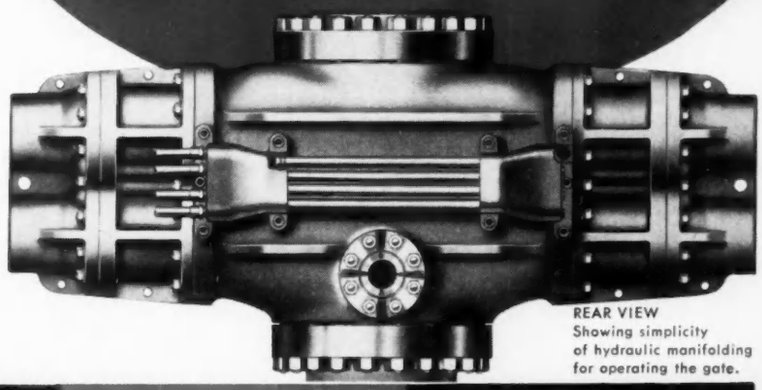


CUTAWAY VIEW
Showing direct hydraulic drive and self-draining ram compartments.

for UTMOST VALUE in Cellar Control Gates – SPECIFY – and GET – These SHAFFER Features

There is a big difference in cellar control gates. And to fully appreciate that difference, compare the important advantages you get in Shaffer Hydraulic Gates with the features of any other similar equipment. You'll find that Shaffer tops the field in advanced engineering... in actual performance... in basic value received per-dollar spent. So to make certain you get the best in cellar control gates, specify—*and make sure you get*—these Shaffer advantages...



REAR VIEW
Showing simplicity of hydraulic manifolding for operating the gate.

specify CONVENIENCE!

Rams must be changed frequently during the life of a well, and no other unit equals Shaffer in ease of changing rams. Simply open two doors in the side of the gate, slide out the ram assembly, change rams, slide the assembly back in place and bolt the doors. Closing the doors automatically aligns the rams for proper operation.

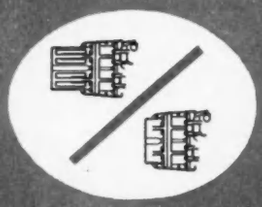
What's more, Shaffer rams can be changed with equal ease whether the pipe is in or out of the hole!

specify COMPACTNESS!

Again its Shaffer, because Shaffer Gates are not only unusually compact, *but no extra space need be allowed for expanding the gate to change rams.*

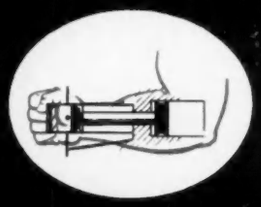
Even in sizes as large as 13⅜" (12"-Series 900), Shaffer Double Gates require only 30" height—Single Gates only 18½"...smaller sizes even less. And length and width dimensions are equally compact!

specify ADAPTABILITY!



Once again its Shaffer, because you get the type of locking shaft *you* prefer. Some operators like the extra compactness of a *Non-Rising* Shaft. Others like the quick indication of ram position they get with a *Rising* Shaft. Take your choice with Shaffer because Shaffer provides *both* types. And both have built-in body extensions to protect the shaft against damage!

specify POSITIVE DRIVE!



When emergencies threaten you want quick, positive closing action in your control gates. And you get it from Shaffer because the operating cylinders are *directly behind* the rams. There are no yokes, no complex connections between piston and ram. Therefore, you not only get greater dependability, but also fewer parts, simpler maintenance!

There are many other "Extra Value" advantages built into Shaffer Hydraulic Gates... such as *Completely Enclosed Design* (no exposed moving parts), *Self-Draining Compartment Bottoms* (no detrimental mud and sand interferes with free ram travel)—and still others. Get the complete story from your nearest Shaffer representative—or write direct!

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"I've ALWAYS preferred KING GA SWIVELS"

King Swivels 32GA and 53GA have been popular for many years. They have proved to be rugged, dependable and durable, and are in use around the world because they are "preferred". The fact that King Oil Tools is the largest manufacturer of lightweight swivels is supporting evidence of King engineering, service efficiency and complete all-around dependability.

INDUSTRY RECOGNIZES KING GA SWIVELS BY THESE FAMOUS FEATURES:
- ALLOY STEELS assure strength with minimum weight.
- PACKING is V-type, often called chevron type.
- WASHPIPES are seamless alloy tubes, case-hardened and ground.
- GREASE LUBRICATION for the packing.
- MULTIPLE BALL BEARING UNITS provide ample capacity.
- OIL BATH LUBRICATION for the bearings.
- Choice of BAIL OR ELEVATOR SHANK.

FOR FULL INFORMATION ON ALL KING SWIVELS — SEE YOUR NEAREST DISTRIBUTOR — OR WRITE:

KING OIL TOOLS
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Call of the Wild

He has Tarzan eyes. They swing from limb to limb.

Punny

Movie Actress: I'll endorse your cigarette for $50,000.

Advertiser: I'll see you inhale first.

She Was Framed

"Good heavens!" cried Whistler as he saw his mother on her knees scrubbing the floor. "Have you gone off your rocker?"

One Moment, Please

Mr. Bronson called his business associate's home in an urgent attempt to reach him. Instead, he got his four-year-old son. After an interval of getting nowhere, he said "Is there anyone else there I could talk to?"

"You could talk to my sister."

"All right, will you get her, please?"

Mr. Bronson heard the receiver laid on the table. After a long interval, the little boy finally came back.

"I couldn't get her out of the play pen!" he panted into the telephone.

Not at All Trustful

It had been a long, tricky case, and the man had just barely been acquitted of a long string of burglaries. He rushed to his attorney and grabbed him by the hand.

"I'll never forget the faith you showed

Over
70
Locations in the United States and Canada

McCullough® REPORTS TO THE OIL INDUSTRY

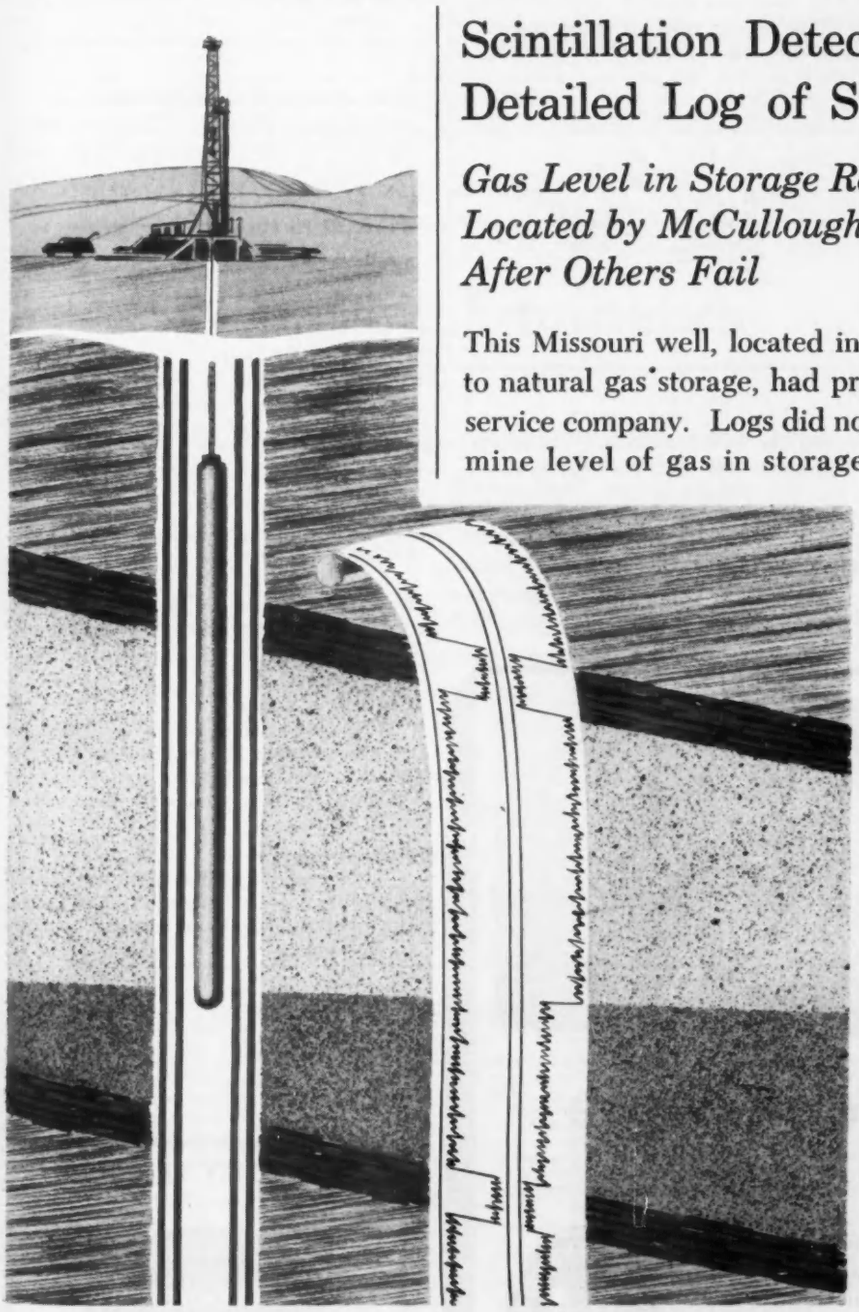
Service
Anywhere Anytime

New Services • • • New Tools • • • New Methods • • • Outstanding Results

Scintillation Detector Provides Detailed Log of Storage Reservoir

Gas Level in Storage Reservoir Accurately Located by McCullough Radiation Well Logger After Others Fail

This Missouri well, located in a field that had been converted to natural gas storage, had previously been logged by another service company. Logs did not show enough detail to determine level of gas in storage reservoir.



Scintillation Detectors, used in McCullough down-hole logging instruments, have an efficiency approaching 100% in detecting and measuring nuclear radiations.

McCullough ran both 5″ = 100′ and 2″ = 100′ scale combination Gamma Ray-Neutron Logs. The clear, accurate detail of the curves showed the exact level of gas in storage. Operator was very pleased with the successful outcome of the job.

The success of this logging operation was not an isolated instance. Later, another well in the same field, previously logged by two other service companies without results, was relogged with McCullough's Radiation Well Logger—again obtaining reliable, accurate Gamma Ray and Neutron Curves.

The job shown above is certified to be a true field report of service rendered.

McCullough® TOOL COMPANY

Cable Address: MACTOOL

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HOUSTON
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CLEAN OUT CHOKING SAND

Excessive sand and sediment holds back your oil. For fast, easy clean out with fewer round trips and less down-time, use world famous Miller Sand Pumps.

SAND PUMP SIZES

O.D.—2½, 3, 3½, 4¼, 5, 5½, 7 In.
Lengths—20, 25, 30 ft.

Composite Catalog, Page 3419

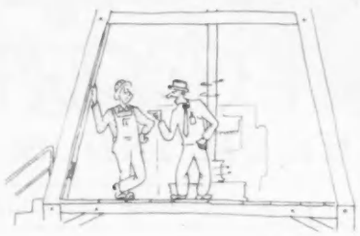
Write for descriptive price list

MILLER SAND PUMPS

Miller Sand Pump Co.

General Offices, Box 4516
Oklahoma City 9, Okla.

EXPORT OFFICES
30 Rockefeller Plaza
NEW YORK CITY 20, N. Y.



"You're not paid to stand around holding up any part of this derrick."

WORLD OIL

in me," he said gratefully. "I'm going to drop in on you one of these days."

"Fine," said the lawyer. "And-uh-make it in the daytime, won't you?"

Mind on the Job

Two camera bugs were draped over a Paris bar discussing their experiences.

"This morning I saw an old crone huddled beneath a bundle of rags," one said. "She was hungry and homeless. She told me she was once a countess but lost her family and money and now was a wretched old woman with nothing to live for."

"The poor thing," said the other photographer. "What did you give her?"

"Well, it was sunny," the first replied, "so I gave her f11 at 1/100."

Pay Attention

Absent minded salesgirl (as her date kissed her goodnight): "Will that be all?"

Back-Handed Compliment

Boss to stenographer: "Congratulations, Miss Jones—this is the earliest you've been late."

Difficult to Hide

The average woman spends 75 percent of her time sitting, as figures will clearly show.

An Idea, At That

The TV repairman was trying to locate the trouble with a friend's set. The six-year-old came dashing home from school. "I'll bet," he said, "if you'd clean out the dead cowboys from the bottom of the set, it would work again."

Fishing for Fun

A puzzled small girl watched a party of anglers putting off in their boat.

"But, Mummy," she asked, "do the fishes like all that beer?"

Chivalry, Dead?

A male passenger on a bus rose and gave a woman his seat, whereupon she fainted. She recovered, and muttered "Thank you," whereupon the man fainted.

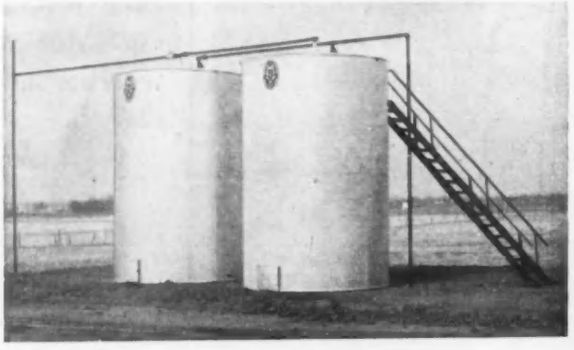
Perspective

Natives who beat drums to beat off evil spirits are objects of scorn to smart American motorists who blow horns to break up traffic jams.

Is This You?

Too many of us are like the old Negro deacon who wound up a long prayer by saying, "Use me, O Lord, use me in thy work—'specially in an advisory capacity."

A WISE CHOICE



M & V Welded Lease STORAGE TANKS

M & V Tanks represent the most rigidly high standards of design, materials, and workmanship. Vapor tight without inspection or maintenance, they are outstandingly permanent and trouble-free.

Delivery and installation are fast and dependable. A complete stock is maintained. M & V Tanks are a wise choice!

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Steel Fabrication for the Oil Industry

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HELP WANTED

Reservoir Engineers

(Ages 27-38)

A major integrated U. S. oil company operating in Venezuela has outstanding career opportunities for qualified RESERVOIR ENGINEERS. Excellent growth possibilities are present in an expanding technical organization. Graduate engineers and physicists who have had FIVE to TEN years of specialized and general petroleum reservoir engineering experience are invited to submit a complete resume of work experience and personal data. Naturally, all replies will be held in confidence and interviews arranged for qualified candidates. Salary, including bonus, $14,900-$18,000, depending on qualifications and experience. Company is a leader in the petroleum industry with excellent employee benefits, including home vacations with travel expenses.

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Department Y-82
New York 19, N.Y.

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■ INCORPORATE in Nevada for oil and mining projects. Do business anywhere. Positively no liability of organizers and stockholders. Over 25 years experience. Financing assistance at no additional cost. Write for Resume. L. O. Goodman, L.L.B., Box 991 Globe, Arizona.

Well organized, well established oilwell drilling contractor desires the management and supervision of oil properties in West Texas, Central Texas, and New Mexico. Can provide complete handling of oil properties from acquisition to production. No properties too small, and none too large to handle. Inquiries from independents, groups, small or medium sized oil companies invited. Write, wire or call collect for further information.

MAKIN DRILLING COMPANY
P. O. Box 1628
Hobbs, New Mexico
Phone: EXpress 3-3141

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HELP WANTED

OVERSEAS OPPORTUNITY

Chaco Petroleum S. A. a subsidiary of Tennessee Gas Transmission Corporation has an opening for a division Geophysicist for its operations in Bolivia. Must have degree in Geology, Geological Engineering, or Geophysics, with at least ten years interpretative experience, including steep, deep and mountain front experience. Excellent opportunities and benefits with our overseas operations. Send complete personal history including education, work experience and family status to:

Earl Parker, Employment Office
Tennessee Gas Transmission Corp.
P. O. Box 2511
Houston 1, Texas

HELP WANTED

WANTED: Experienced accountant for aggressive, Denver based, independent oil firm. Must be able to assume office manager position. Excellent salary for top caliber man, send complete resume to Box 146-W, WORLD OIL, Houston, Texas.

WANTED: Geologist with top qualifications for top paying job with aggressive Denver independent, active in Colorado and Canada. Canadian experience desirable but not necessary. Send references and qualifications to Box 145-W, WORLD OIL, Houston, Texas.

SITUATIONS WANTED

■ EFFICIENT SUPERVISION of oil operations. Registered Professional Petroleum Engineer, 32, eleven years production, valuation, drilling, geology, leasing, and management experience with majors and independent. Box 148-W, WORLD OIL, Houston, Texas.

FOR SALE

■ Magnetometer, Vertical temperature compensated ten gammas scale division, Askania, Excellent condition. $900.00. Box 149-W, WORLD OIL, Houston, Texas.

FOR SALE: Model RL Cardwell spudder. Equipped to service 8000 foot wells. In excellent repair. Presently operating Ft. Morgan, Colorado area. Considerable company work will be given purchaser. Contact Lowell J. Williamson, 2150 South Bellaire, Denver, Colorado, SKyline 6-8333.

FOR SALE

5 x 10 KLS 1 Worthington Mud Pump, with MZ Waukesha Skid Mounted and one 5 x 10 FXO belt driven with Waukesha Engine.

One 7¼ x 12 Wilson Snyder Pump. 7 x 14 Bethlehem, two inch CMC centrifugal pump. 85 cubic Ingersoll Rand Compressor, gas driven.

750 foot drilling rig, complete trailer mounted.

Halliburton power driven measuring assembly. 12 inch OBL Brewster Rotary.

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They Pay

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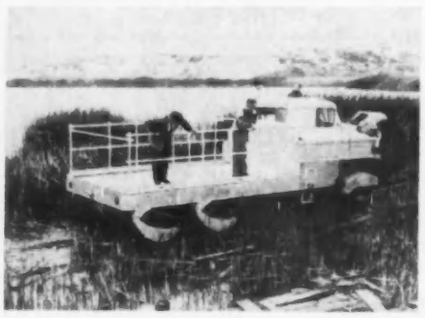
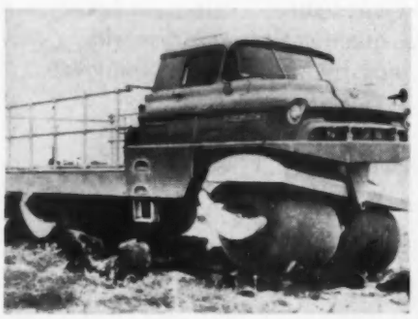
Drilling - Production - Exploration





Wheelless Truck

Built to operate off-the-road where even pack mules fear to tread, this wheelless truck is able to carry a seven-ton payload cross country over rocks, swamp, brush, snow and light timber deadfall as cheaply as an ordinary truck rolling along a smooth modern highway. It is built by The Albee Rolligon Company.

This cargo transport called the "ARC," "floats" its load overland—but the modern way, on six huge sausage-shaped pneumatic pillows it uses in place of conventional wheels.

Its builders, expect it to be used to open up vast wilderness areas in many parts of the world by providing economical mechanized transportation to these regions which cannot afford highways and railroads.

Its performance in traversing swamp, soft sand, obstacles like rocks and logs, a two-log wilderness bridge, is possible because of the extremely low air pressures of its air bags which press the ground at only two to three pounds when the truck is empty (about 70 pounds for a comparable highway truck), and as low as five pounds fully loaded with seven tons.

How unlike wheels modern Rolligon bags are, is illustrated by the fact they operate best when in a condition roughly the shape and feel of a semi-inflated air pillow. This way they are spreading their greatest contact area upon the ground for greatest distribution of the vehicle's weight and load. They are also in best form to "absorb" rocks and other obstacles by "flowing around them"—providing a completely air-cushioned, shock-free ride.

The ARC is expected to have many uses not necessarily related to developing the world's last primitive areas. Included is low cost transportation for localized off-road operation like logging, mining, geophysical exploration, disaster and civil defense use, fire fighting and airport use and many military applications. They may even be conscripted for backyard jobs like hauling building materials to muddy construction sites.

All six bags of the ARC can be driven and their pressures controlled from the driver's cab as necessitated by the terrain encountered. Top speed is in excess of 40 miles per hour.

For more data, circle **No. E1** on Readers' Service Card, last page this issue.

Transistor Radio Line

General Electric Company's Communication Products department announced that it has developed the communication industry's first transistor-powered line of mobile radio equipment.

A 60-watt mobile unit is a feature of the new line and is now in pilot production. As a result of the design of the new 60-watt mobile unit, GE now is able to offer 30 or 60 watt transistor powered mobile radios in low band (25-54 mc), 25 or 50 watts in high band (144-174 mc) and 15 watts in Citizens' Band (450-470 mc).

(This item supplements General Electric Co., Electronics Division, data on Pages 2019-2020 of the Composite Catalog, 22nd Edition.)

For more data, circle **No. E2** on Readers' Service Card, last page this issue.

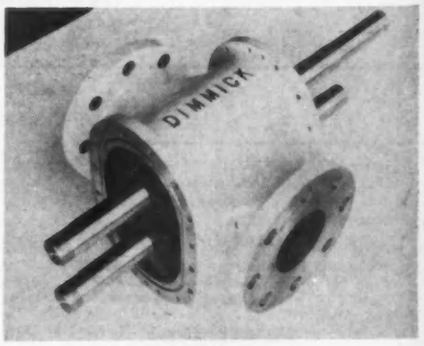
High Power Station

General Electric Company is now in production on a new high power UHF base station radio transmitter designed to give dispatchers of mobile communication systems more ability to reach vehicles traveling in outlying areas. Engineered to deliver up to 250 watts, the unit may be licensed for operation in the 450-460 mc band.

The new transmitter increases power output up to 12 db and enables dispatchers to talk up to 50 percent farther. In terms of square miles a 12 db increase in power can more than double the area of coverage.

(This item supplements General Electric Co., Electronics Division, data on Pages 2019-2020 of the Composite Catalog, 22nd Edition.)

For more data, circle **No. E3** on Readers' Service Card, last page this issue.

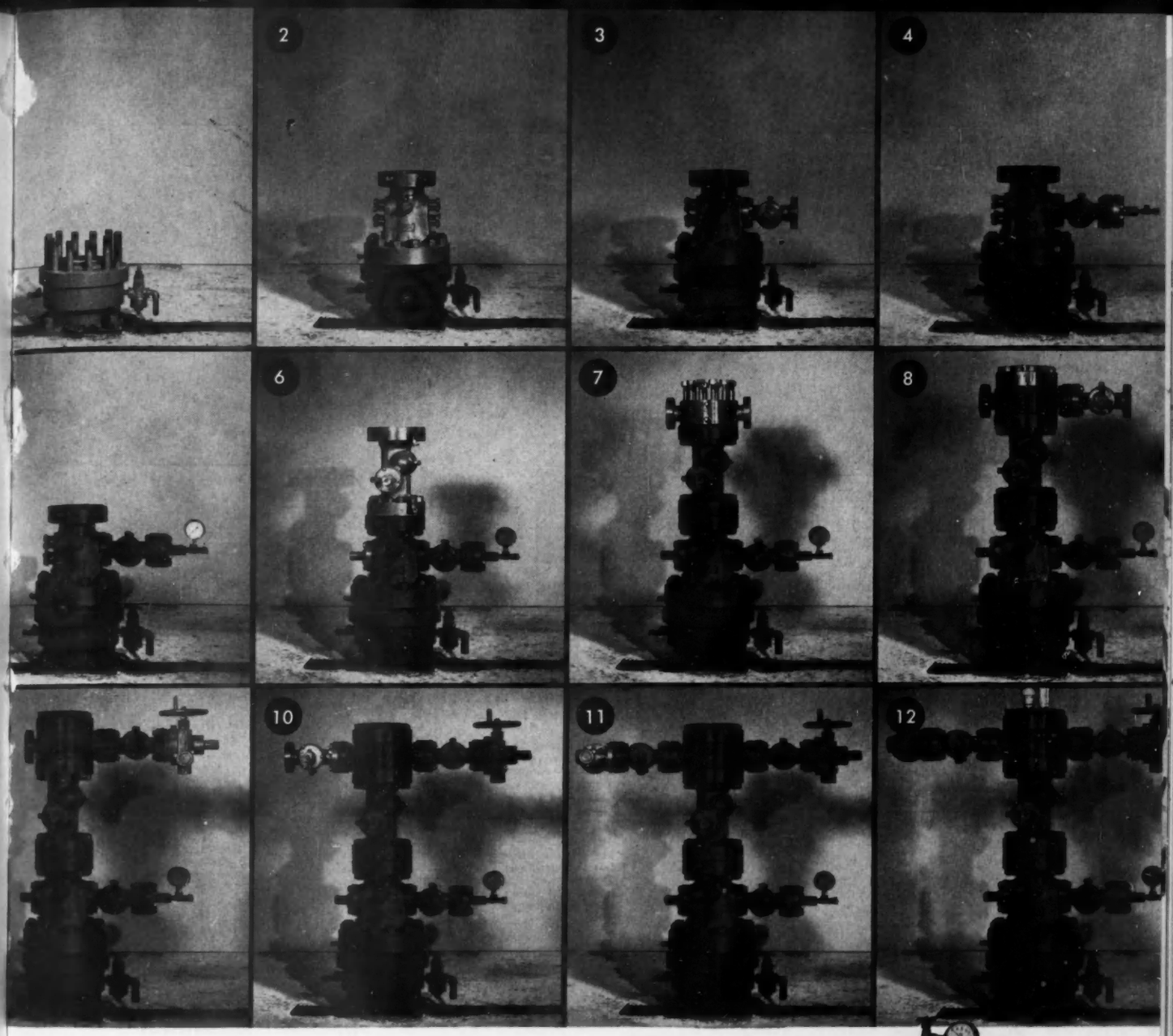


3-Inch Rotary Pump

Products, Inc., Tulsa, has announced that the new Dimmick three-inch positive displacement rotary pump has gone into full-scale production.

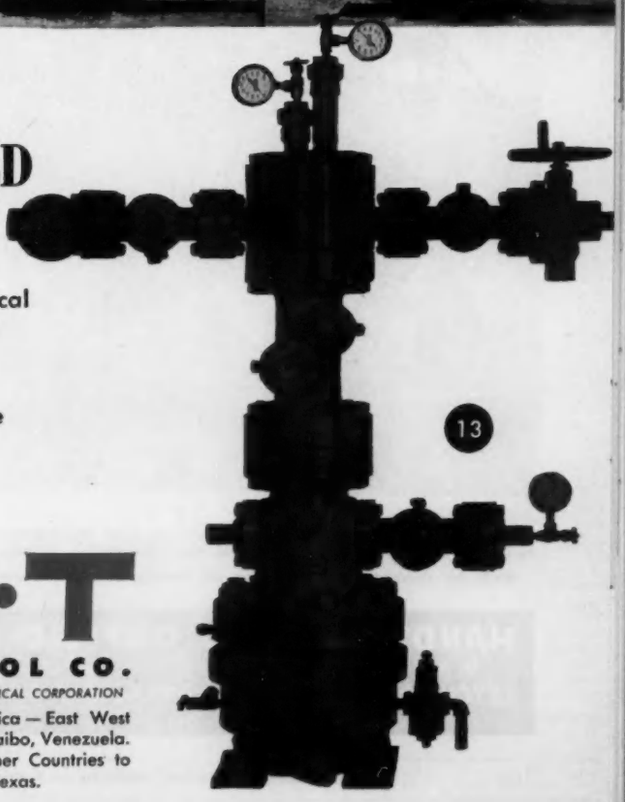
The pump operates under the positive displacement principle. As the impellers unmesh, a vacuum is produced which draws the liquid into the space between the lobes. The liquid moves between the lobes and case housing to the opposite side of the pump. When the impellers mesh, the liquid is forced into the discharge line.

The ports of the pump are so designed



"STEP-BY-STEP STORY" of the BEST DUAL ASSEMBLY IN THE FIELD

From the first bolt to the last gauge, the dual tree shown above in the various stages of growth, represents the most practical and efficient dual well control equipment in the field.
It is an O-C-T Dual Tree, including the new and revolutionary O-C-T Universal Tubing Head.
Dual assemblies, pioneered by O-C-T and now improved to give you even greater versatility, answer long existing problems.
For deep or shallow multiple pay zones... if you make **any** kind of dual completion... make it O-C-T, the pioneer and leader in dual completion equipment.



where progress is a daily practice

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SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

Export Representatives: South America — East West Oiltools, C. A., Del Lago Hotel, Maracaibo, Venezuela.
Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston, Texas.

that the liquid is spread across the full width of the impellers and the liquid velocity is coordinated with the speed of the pumping impellers. This allows the liquid to be pumped with minimum energy loss from turbulence and friction.

The pump is self-priming, has positive suction and is completely reversible. It can be operated in either direction by reversing the power unit. Relatively light (147 pounds), it can pump all liquids from water to high viscosity fluids and abrasives including up to 78 percent solid materials. Castings for the pump are made of Meehanite metal to allow high discharge pressures. The impellers are Neoprene, Hy-Car or natural gum rubber.

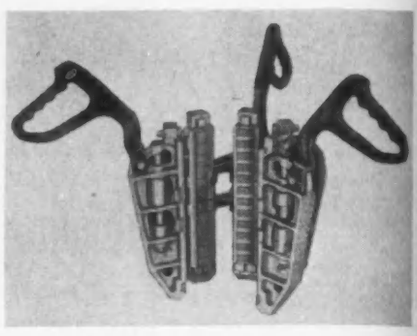
For more data, circle **No. E4** on Readers' Service Card, last page this issue.

DRILLING

Bantam Rotary Slips

Baash-Ross has announced a new, lightweight rotary slips designated the Type G Bantam Slips. Designed to minimize crew fatigue without sacrificing rugged construction, the 4½-inch size weighs only 96 pounds.

Manufactured for all standard types and sizes of rotary tables, they are made in three body sizes—2⅞ inches, 4½ inches and 5½ inches. A unique unitized design assures uniform setting of the multi-body segments in any rotary table. Rated capacity is 7500 feet of 4½-inch drill pipe.



(This item supplements Baash-Ross Tool Co., Division of Joy Manufacturing Co., data on Pages 389-520 of the Composite Catalog, 22nd Edition.)

For more data, circle **No. E5** on Readers' Service Card, last page this issue.

BRITISH H/E MADE

300 P.A. TRACTOR DRILLMASTER

MULTI-PURPOSE · HIGHLY MOBILE

The Hands-England 300 P. A. Drillmaster Rotary Drill is now available mounted on a Fordson Major Industrial Tractor and is illustrated on left.

This design provides great manoeuvreability and is intended primarily to enable the well known H/E Drillmaster 300 P. A. Rotary Drill to be used for Quarry and Open Cast blast hole, shot hole, auger, core or sample drilling.

Although the H/E Drillmaster 300 P. A. mounted on a diesel engined agricultural tractor, is ideal for Quarry and Open/Cast operations, it is equally applicable to some difficult "off the road" locations, such as may be encountered during seismic exploration or shot hole drilling.

In areas where a light drill with high tractive effort and good manoeuvreability is required, the H/E Tractor Drillmaster will be found to have much advantage over the conventional type of truck mounted drill.

Standard equipment provides for drilling holes of 2⅜" to 4" in diameter or to ream out 2⅜" diameter holes to larger sizes. Extra equipment can be supplied for cutting larger holes up to 5⅝" diameter, if desired.

For flushing cuttings to the surface an air compressor can be mounted directly onto the H/E Tractor Drillmaster and driven by the Tractor Engine. The compressor can achieve an up-hole annular velocity of 3,000 ft. per min.—using 'B' rod and 3" dia. bits. If air drilling is to be employed for larger holes, or where mud circulation is necessary, the equipment for these operations must be mounted on a separate trailer or tractor.

The H/E Tractor Drillmaster will be found to cover the majority of drilling requirements of the Quarry and Open Cast operator, the Geologist, the Mineralogist, and the Geophysicist.

Write for illustrated folders giving full details and specifications of this equipment.

HANDS-ENGLAND OILFIELD EQUIPMENT LTD

MANUFACTURERS OF GEOPHYSICAL SUPPLIES

LETCHWORTH HERTS ENGLAND TEL: 600 CABLES: OIL LETCHWORTH ENGLAND

Exclusive licensees in Western Germany: August Goettker Flachbohrungen, 20a Wathlingen Kreis Celle, West Germany

Spiro-Jet Desander

Grant Oil Tool Company recently unveiled its new Spiro-Jet Desander. The new unit, which weighs only 56 pounds, operates effectively under wide variations in pump pressures, maintaining clay and oil base muds in sand-free condition under all normal drilling operations.

The heart of the new Spiro-Jet Desander is a one-piece liner of speecial oil and abrasive resistant rubber developed by Grant-MacClatchie specialists. The one-piece unit is low in initial cost, and is quickly and economically replaced as a unit when worn. This completely eliminates the need for changing several separate rubber sections, and the additional replacement expense and downtime ordinarily required. The one-piece liner provides the exact conical design required for efficient desanding.

(This item supplements Grant Oil Tool Co., MacClatchie Manufacturing Co. Division, data on Pages 3145-3152 of the Composite Catalog, 22nd Edition.)

For more data, circle **No. E6** on Readers' Service Card, last page this issue.

Low Viscosity C.M.C.

Kirklees Ltd., England, has produced a low viscosity grade of C.M.C., which is suited to the needs of the oil well driller, whether in fresh water conditions,

HOT...

but not bothered

By High Temperatures in Deep Drilling With KYLO* Brand Additive for Drilling Mud

When you encounter high temperatures in deep holes, that's the time to use KYLO additive in your mud. It conditions the mud, reduces filtration, makes a tough, slick filter cake and reduces the incidence of stuck pipe, bridging or caving troubles.

KYLO mud additive is easily mixed through the conventional hopper. You can use it in a wide range of muds treated with any of the common mud chemicals.

KYLO, a new mud additive distributed by Baroid, is field-proved. Write today for newest technical data on this product.

*Manufactured by Minnesota Mining and Manufacturing Company. Trade Mark Registered U. S. Patent Office.

BAROID

BAROID

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Please send me data on KYLO Additive.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

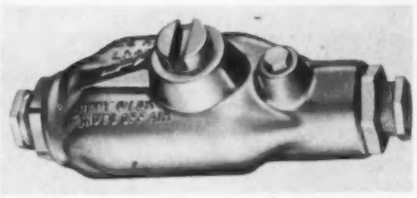
in salt-contaminated, saturated brine or calcium-contaminated conditions.

"Kirkose" is sodium carboxymethyl cellulose. Two of the grades of this substance, called the Kirkose oil drilling grades, are specially made as fluid loss control agents in the oil drilling industry. These two grades are different in the viscosity increase which they confer upon a drilling mud, and are called the very low viscosity and the high viscosity grades, respectively, according to their power of increasing the viscosity of solutions in water.

For more data, circle **No. E7** on Readers' Service Card, last page this issue.

Automatic Line Oiler

A new automatic line oiler which shuts-off the air supply when the oil is used-up



is now being manufactured and marketed by the Le Roi Division, Westinghouse Air Brake Co.

Lack of oil, the most prevalent cause of air tool damage, is eliminated by the new L0380, which is light in weight, easily adjusted and refillable while in use. The positive type oil-pickup feeds oil the instant drilling starts; the moment the oil supply is exhausted, the air supply to the air tool is shut-off automatically. Its one-pint capacity is more than adequate for one shift of operation.

In addition to its automatic protection, the new oiler prevents the waste of excessive oiling due to inadequate adjustments of conventional line oilers. The new oiler can be refilled while in operation, thereby eliminating drilling interruptions. Oil flow, too, can be adjusted without shutting-off air pressure.

(This item supplements LeRoi Division, Westinghouse Air Brake Co. data on Pages 3009-3012 of the Composite Catalog, 22nd Edition.)

For more data, circle **No. E8** on Readers' Service Card, last page this issue.

FIRST TIME OFFERED TO THE INDUSTRY

MARTIN-DECKER

compound pressure gauges

THE ULTIMATE IN QUICK EASY CHECK OF PRESSURE AND PRESSURE CHANGES

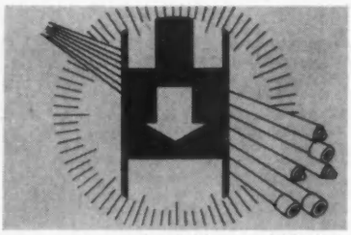
THE VERNIER POINTER
Makes 4 complete revolutions for the full scale of the gauge giving *greater sensitivity* and much *easier reading with the same accuracy.*

THE STANDARD POINTER
Makes one revolution for the full scale of the gauge with typical Martin-Decker accuracy and dependability.

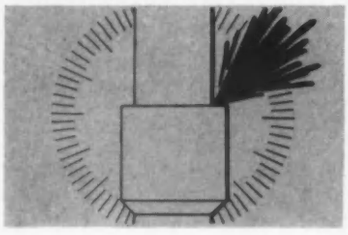
Compound Pressure Gauges Available In:

4,000 lbs. 8,000 lbs.
12,000 lbs. 16,000 lbs.

for fracturing or cement squeeze jobs.



for testing tubing or drill pipe.

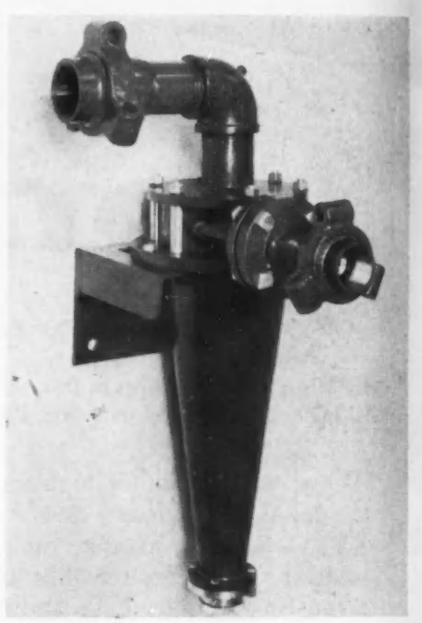


for detecting drill pipe leaks.

Write For Descriptive Literature!

MARTIN-DECKER CORP.

HOME OF THE WEIGHT INDICATOR — LONG BEACH, CALIFORNIA



Desanding Unit

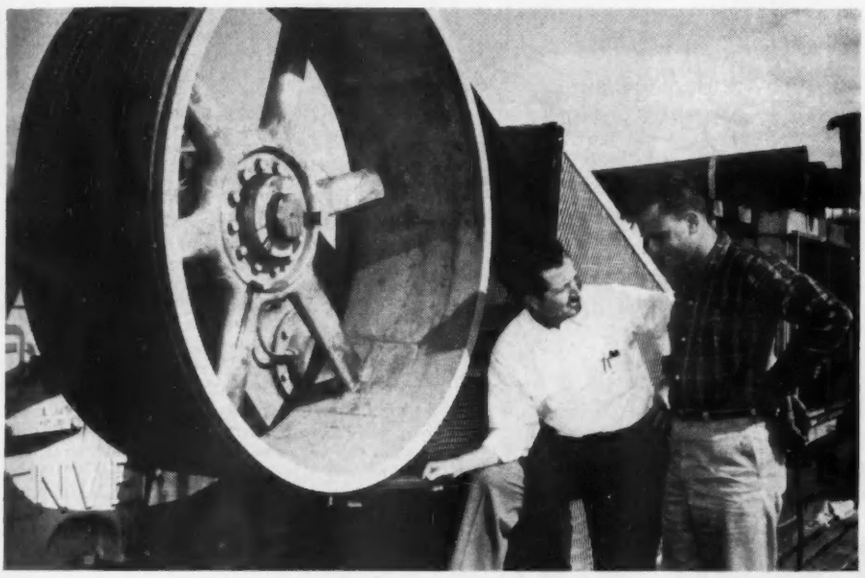
A new unit for removing sand and cuttings from drilling mud is currently being introduced by the Drilling Equipment Manufacturing Company. Identified commercially as the "Demco Desander," the unit was described as the "result of a new concept of construction which offers several advantages over similar purpose units."

All wear surfaces on the Demco Desander are protected by oil and abrasion resistant neoprene, ½ inch in thickness. One of the major features is a molded neoprene liner, which protects the interior surfaces of a conical steel separating chamber. The liner may be replaced at necessary intervals and thus extends indefinitely the life and efficiency of the unit. Since the cone itself is steel, efficient shape is maintained with only a minimum in ID variance due to wear because wear is reduced to the replaceable liner only. The steel cone, of course, retains its rigidity and possibility of "scooping out" within the cone is eliminated.

(This item supplements Drilling Equipment Manufacturing Company data on Pages 1538-1541 of the Composite Catalog, 22nd Edition.)

For more data, circle **No. E9** on Readers' Service Card, last page this issue.

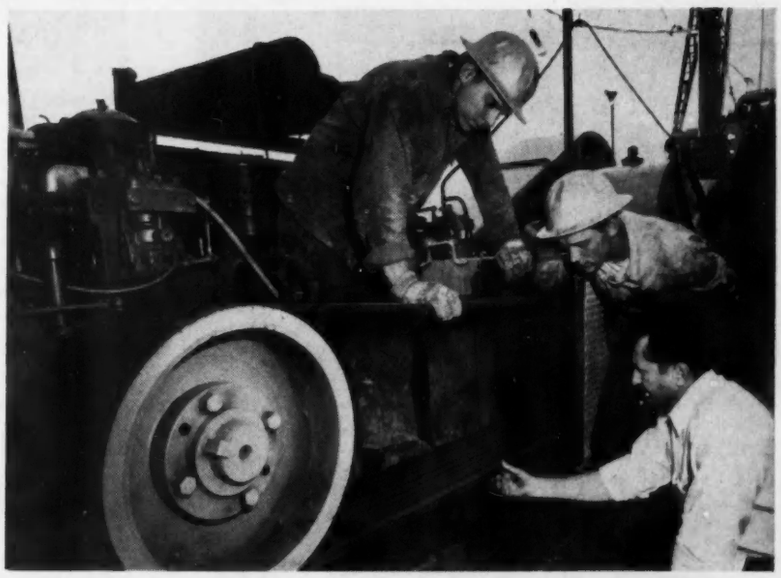
12 Wells in 8 Months and No Downtime, using one set of DAYTON V-BELTS



Jack Gresham, Toolpusher on Big Six Corporation's Rig # 2, says, "8 months ago, we switched to multi-matched Dayton Super-Thorobred V-Belts. Since then, Rig #5 has been on 12 jobs—sinking holes that averaged 9,000 feet in depth. In over 5000 hours of drilling, with the mud pump operating at 1800 psi, Dayton V-Belts have never caused one minute's downtime." Mr. Gresham is shown at the right, talking to Dayton Representative Werner Zapp.

"Because they're unaffected by oil, heat, moisture and static build-up, Dayton Super-Thorobreds resist every destructive condition we've found in our drilling operations. For instance, we were overtensioning our former V-Belts to compensate for slippage due to belt stretch. Using surer gripping Dayton Super-Thorobreds, with their extra strength cord section, we can slack off the tension while maintaining full power. That way, we let the belts soak up shock and vibration that was transmitted to the pump.

"Dayton believes in service, too. Our Dayton Distributor in Houston, is backed up with a large warehouse stock. Thus, we get the belts we need, have them multi-matched and at the rig in half an hour."



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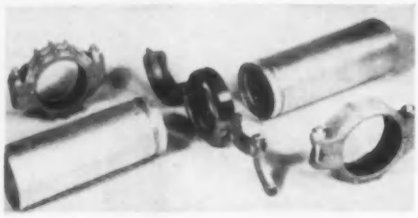
Insist on Dayton Multi-Matched V-Belts

Dayton Rubber

World's Largest Manufacturer of V-Belts

DAYTON RUBBER COMPANY • INDUSTRIAL REPLACEMENT DIVISION • DAYTON 1, OHIO

PRODUCTION



Quick Coupling Method

A new and economical method of quick coupling thin wall steel and aluminum pipe and tubing has just been introduced by the Victaulic Company of America.

Named "Vic-Easy" by the manufacturer, the new method provides positive, leak-tight connections through the use of quick couplings assembled on Vic-Easy grooved pipe ends. There is no loss of metal in the rolling and the pipe or tubing is as sound structurally as when manufactured.

The "Vic-Easy" Method is available for thin wall pipe and tubing in sizes from 1¼ inches to 12 inches, and may be used for working pressures up to 1000 pounds per square inch, depending on the wall thickness of the tubing and type of coupling used.

(This item supplements Victaulic Company of America data on Page 5254 of the Composite Catalog, 22nd Edition.)

For more data, circle **No. E10** on Readers' Service Card, last page this issue.

men with Oil in their blood

Seldom do Legrand users have a change of heart, they know the importance of rugged, dependable pumping equipment. Available to meet all oilfield pumping demands are units from 3,000 lbs. to 33,000 lbs. polished rod load and 24" to 132" stroke. All units are floor clearing with rack-and-pinion balance weight adjustment, API Standard gear reducers, LEGRAND patented double-taper wristpins, self-aligning equalizer and wristpin bearings, lateral and fore-and-aft beam adjustment, swing back mulehead, LEGRAND patented carrier bar, ground level lubrication, all bolting in "Unified" series. Incorporating the most up-to-date design features LEGRAND Pumping Units are the result of long practical experience in the Oil Fields of the World.

LEGRAND

also Manufacturers of LEGRAND-O.C.T. Wellhead Equipment: LEGRAND-HOWCO Floating Equipment: LEGRAND-S.C. CARTER Long-stroke Hydraulic Pumping Units.

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Puerto La Cruz,
E. Venezuela.

Western
A-Z Export, S.A.
Apartado 304,
Maracaibo,
W. Venezuela.

Water-Flood Meter

New Neptune Meter Company one-inch water-flood meter is designed especially for high-pressure metering of corrosive saline water being pumped into underground oilfield recovery projects. The new meter's corrosion-resistant nickel-alloy measuring chamber and special nickel-alloy gears, pinions and spindles assure long, accurate service under the most demanding field conditions.

Maximum operating pressure is 2000 pounds per square inch; maximum operating temperature is 150 degrees F. Capacity is 70 barrels per hour maximum, 7 barrels per hour minimum. Register is straight-reading type with a totalizer capacity of 999,999 barrels. Couplings can be furnished with tailpiece having one-inch pipe threads.

There is only one moving part—the measuring disc—in the measuring chamber. This simplicity of design means longer service life without wear or corrosion. The measuring chamber is surrounded by water at line pressure, eliminating an important cause of distortion.

For more data, circle **No. E11** on Readers' Service Card, last page this issue.

Submergible Well Pumps

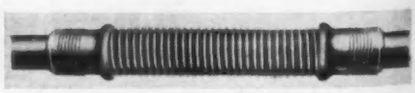
A new series of oil well pumps designed for wells producing from 250 to 600 barrels per day has been announced by the Reda Pump Company.

The new "450" series submergible pumps includes pumps from 7½ to 20 horsepower for well casings of 5½ inches and larger.

These new pumps will lift fluids from depths of 900 to 4400 feet, with fully automatic operation available. Models are available for operation from 440, 762 or 880-volt sources.

(This item supplements Reda Pump Company data on Pages 4537-4540 of the Composite Catalog, 22nd Edition.)

For more data, circle **No. E12** on Readers' Service Card, last page this issue.



Sand Free Filter

Sand cutting and scoring as well as sand stuck pumps can be reduced signifi-

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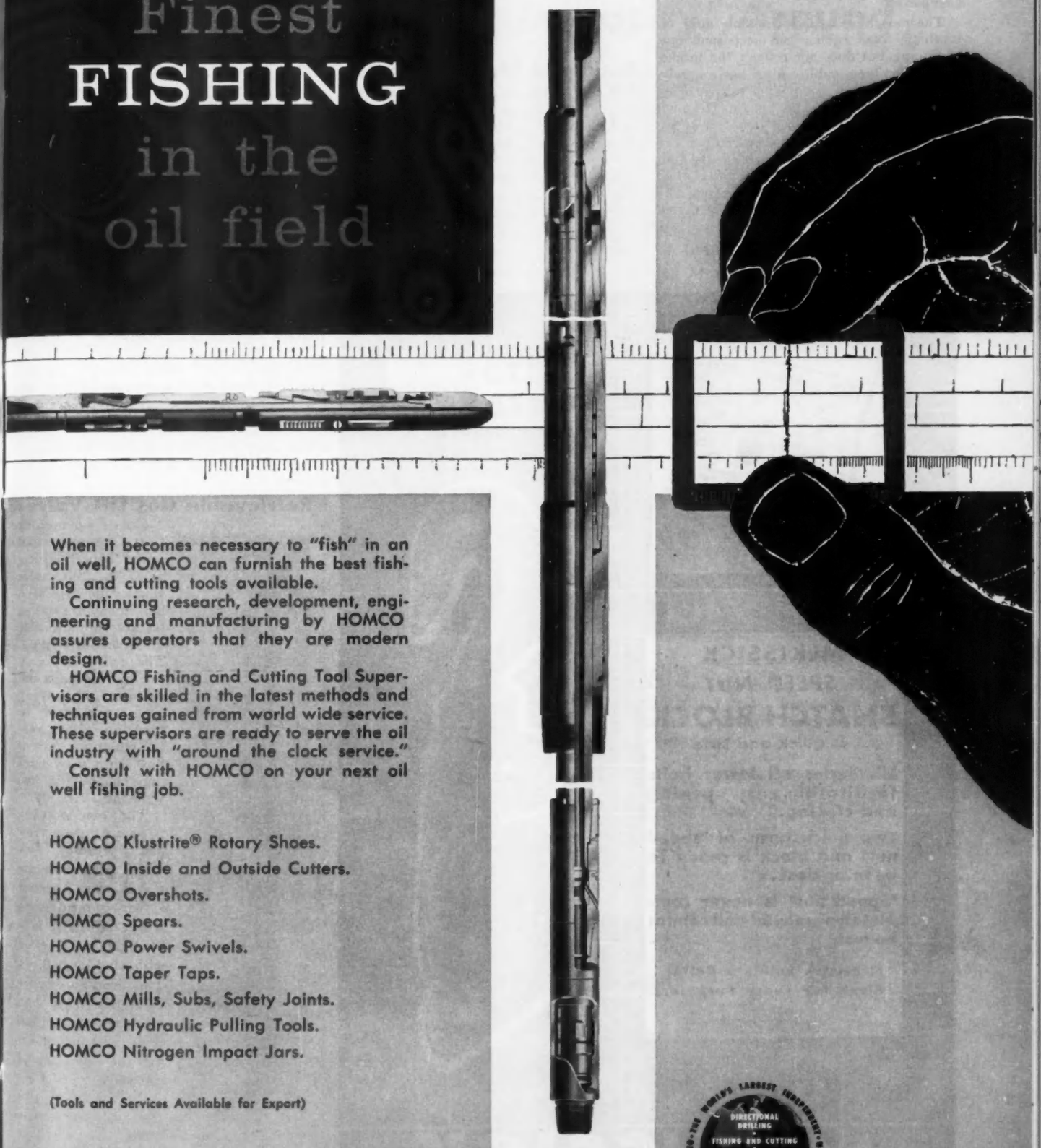
HOUSTON OIL FIELD MATERIAL COMPANY, Inc.

FISHING AND CUTTING



When it becomes necessary to "fish" in an oil well, HOMCO can furnish the best fishing and cutting tools available.

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Consult with HOMCO on your next oil well fishing job.

HOMCO Klustrite® Rotary Shoes.
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HOMCO Overshots.
HOMCO Spears.
HOMCO Power Swivels.
HOMCO Taper Taps.
HOMCO Mills, Subs, Safety Joints.
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HOMCO Nitrogen Impact Jars.

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cantly through the use of the new Clayton Mark sand free filter, sold and distributed exclusively by Continental-Emsco Company.

The new filter's special flexible filter of synthetic foam rubber can keep sand out of pumps, but does not restrict the intake of oil. The foam rubber filter has a barely perceptible compression on the up-stroke, and at that time strains the oil, leaving the sand clinging to the outside of the element. On the downstroke the filter relaxes and sloughs off the sand with that relaxing movement. Since the filter does have a "breathing" action, it cannot become clogged as ordinary screens or metal strainers.

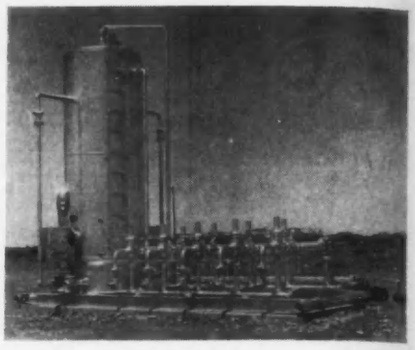
(This item supplements Continental-Emsco Co. data on Pages 1381-1388 and 1442 and 1621-1680 and 1685 of the Composite Catalog, 22nd Edition.)

For more data, circle **No. E13** on Readers' Service Card, last page this issue.

Packaged Well Test Units

Sivalls Tanks, Inc., announced development of a complete line of automatic, skid-mounted, packaged well test units. Known as Siv-O-Matic well testers, these units consist of standard, skid-mounted, automatic well switching manifolds, with test metering separator and control panel mounted on the skid.

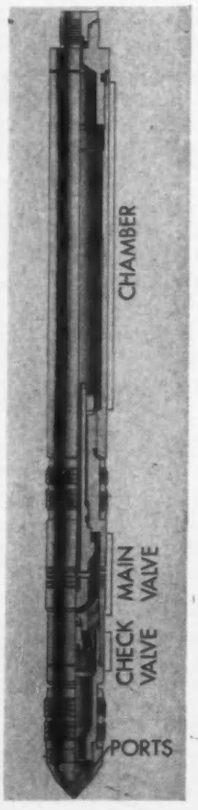
The Siv-O-Matic manifold is fabricated and tested in the shop, and connected to



the metering test separator mounted on one end of the skid. Some standard units also include a production separator mounted on the opposite end of the skid and connected to the manifold. The electric control panel is mounted on the skid, and all wiring is installed in explosion-proof conduit and tested in the shop. Well switching valves are penumatic three-way motor valves controlled by electric solenoid pilot valves which are controlled by the test programming system in the control panel.

For more data, circle **No. E14** on Readers' Service Card, last page this issue.

Retrievable Gas Lift Valve



Otis Engineering Corp. has announced a new Type F retrievable gas lift valve which, the firm says, has many operating features not available in other equipment. The valve has only two moving parts and no metal moving parts, and can be used for either continuous or intermittent flow, simply by making changes at the wellhead.

The two moving parts are a main valve and a reverse check valve. Both parts are a resilient, special Hycar composition which effects a bubble-tight seal, even with sand-laden fluids. This permits acidizing, fracturing and other remedial operations without affecting the operation of the valves. The composition elements are said to resist erosion better than metal, and also eliminate bleed-down of casing pressure often caused by metal valve seats.

The valve has large ports which assure an ample supply of gas to lift a given fluid load at optimum efficiency, thereby reducing slippage.

For more data, circle **No. E15** on Readers' Service Card, last page this issue.

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SPEED NUT
SNATCH BLOCK
Is quick and safe
Eliminates all lower bolts facilitating easy opening and closing.
Two quick turns of "speed nut" and block is ready to open or close.
"Speed nut" is never completely removed and cannot be lost.
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Catalog on Request
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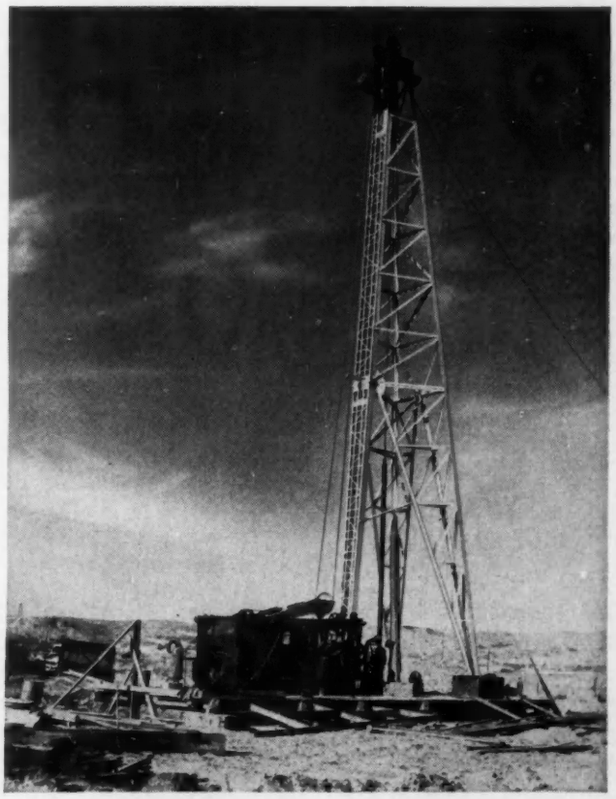
HEAVY-DUTY TRIPOD DERRICK
Lets You Move "Big Capacity" Around

For use with both 36-L and 48-L spudders, Bucyrus-Erie's heavy-duty tripod derrick has sufficient height and stability to handle casing loads up to 300,000 pounds when rigged for 10-part hoist. Completely raised, the derrick is 70′ 4″ high.

Despite the derrick's size, spudder mobility is retained. Erected in five easy steps, this derrick is easy to tear down and move. Each of the five units can be disassembled and transported separately. Look: 45557



36-L Top-to-bottom drilling to 3,500 feet. Servicing to 4,000 feet. Swings up to 5,000 pounds of tools.

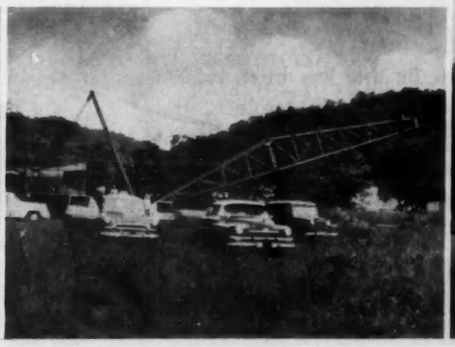
48-L Top-to-bottom drilling to 6,000 feet. Servicing to 7,000 feet. Swings up to 6,700 pounds of tools.

BUCYRUS ERIE

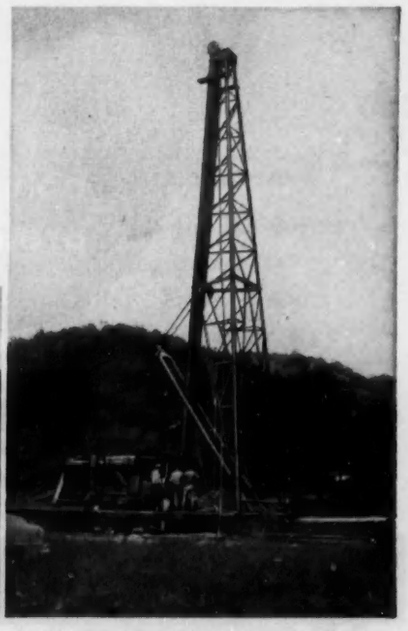
Write today for complete information.

BUCYRUS-ERIE COMPANY
South Milwaukee, Wis.

1. Derrick sections are assembled on the ground. Legs are hinged to the base and the gin pole is set in place preparatory to raising derrick.



2. Using the bull reel drum for hoisting, the derrick begins to rise. Hinged front lower section is pulled into place by the derrick hoist.



3. When the derrick is completely raised, the gin pole is removed and the front lower section is attached.

For more data on advertised products, use Readers' Service Cards, last page.

Metering Assemblies

In order to provide complete automatic crude oil lease measurements to oil field operations, Maintenance Mechanical Corporation, a subsidiary of Maintenance Engineering Corporation, now furnishes skid-mounted automatic crude oil metering assemblies with proportional samplers.

The pre-set set stop counter automatically shuts the unit down after the monthly oil allowable has been flowed. An automatic temperature mechanism incorporated in the positive displacement meter automatically corrects the volume of oil measured to 60 degrees before registering it on the counter and/or ticket printer.

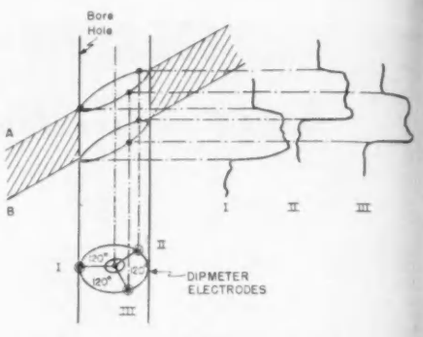
An adjustable quantity sample of the fluid passing through the meter is taken in proportion to the flow and stored at line pressure in the Meco Sampler.

(This item supplements Maintenance Engineering Corp. data on Pages 3166-3169 of the Composite Catalog, 22nd Edition.)

For more data, circle **No. E16** on Readers' Service Card, last page this issue.

Dip Calculator

Schlumberger Well Surveying Company's dipmeter comparators is a device that optically superimposes one curve upon the other and in different colors for calculating the dip of a formation from the



dipmeter. When a dipmeter log is placed under the comparator, the operator sees two different colored images of each of the three dipmeter curves. These images can be shifted to match each other by the use of two control knobs (transverse shift and lateral shift). The lateral shift is calibrated to record directly the depth shift between curves thus providing the necessary data for dip calculations. This optical superimposing of one curve upon the other is fast and accurate.

(This item supplements Schlumberger Well Surveying Corp. data on Pages 4621-4652-L of the Composite Catalog, 22nd Edition.)

For more data, circle **No. E17** on Readers' Service Card, last page this issue.

Indirect Heater

A new indirect heater equipped with a stormproof modern jet type burner and pilot has been announced by the Parkersburg Rig and Reel Company. Heaters are available in a complete range with input capacities to water bath of 90,000 btu-hr to 4,000,000 btu-hr.

The oil or gas enters the heater through the inlet terminal, circulates inside a return-bend coil while being heated by the water bath surrounding the coil, and exits through the outlet terminal. Flow coil is located in the upper half of the shell in the hottest area of the heat transfer media—thus taking full advantage of thermosyphoning for heat transfer by convection.

(This item supplements Parkersburg Rig and Reel Company data on Pages 4221-4264 of the Composite Catalog, 22nd Edition.)

For more data, circle **No. E18** on Readers' Service Card, last page this issue.

Corrosion Caliper

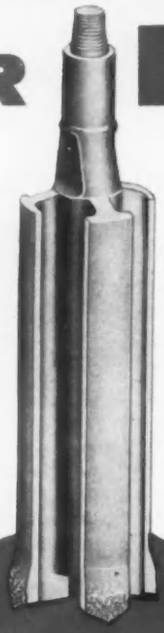
The M. M. Kinley corrosion caliper that for the first time provides a complete picture of well tubing as deep as 14,000 feet continuously was introduced recently.

The new Kinley Microscopic Caliper has a separate stylus for each feeler. Although the concept of a separate stylus for each feeler had been used before, in a well caliper for open hole, the problems involved in making the Microscopic Caliper were many and complex. The new Kinley caliper not only solves these numerous and complex problems, but furthermore, it provides the improvement of introducing a third dimension into the record.

(This item supplements M. M. Kinley Co. data on Page 2847 of the Composite Catalog, 22nd Edition.)

For more data, circle **No. E19** on Readers' Service Card, last page this issue.

FABRICATED STAR BITS



The Fabricated Star Bit shown here has been designed especially for big hole drilling in hard formations. Far more efficient than the old style spudding bit and the big hole paddle-type bit, these Star Bits are custom-engineered to suit the particular hole size and the capacity of the drilling machine used.

Spang Fabricated Star Bits save labor and money. They can be quickly dressed to gauge, and speedily ready for drilling, by hard surfacing the cutting edge.

For drilling large diameter holes profitably

Here is a Fabricated Star Bit that has been successfully proven on numerous large hole projects. It is available in a wide range of diameters, and weights . . . the lengths in which they can be furnished are directly related to their overall weight.

Complete details and literature on request.

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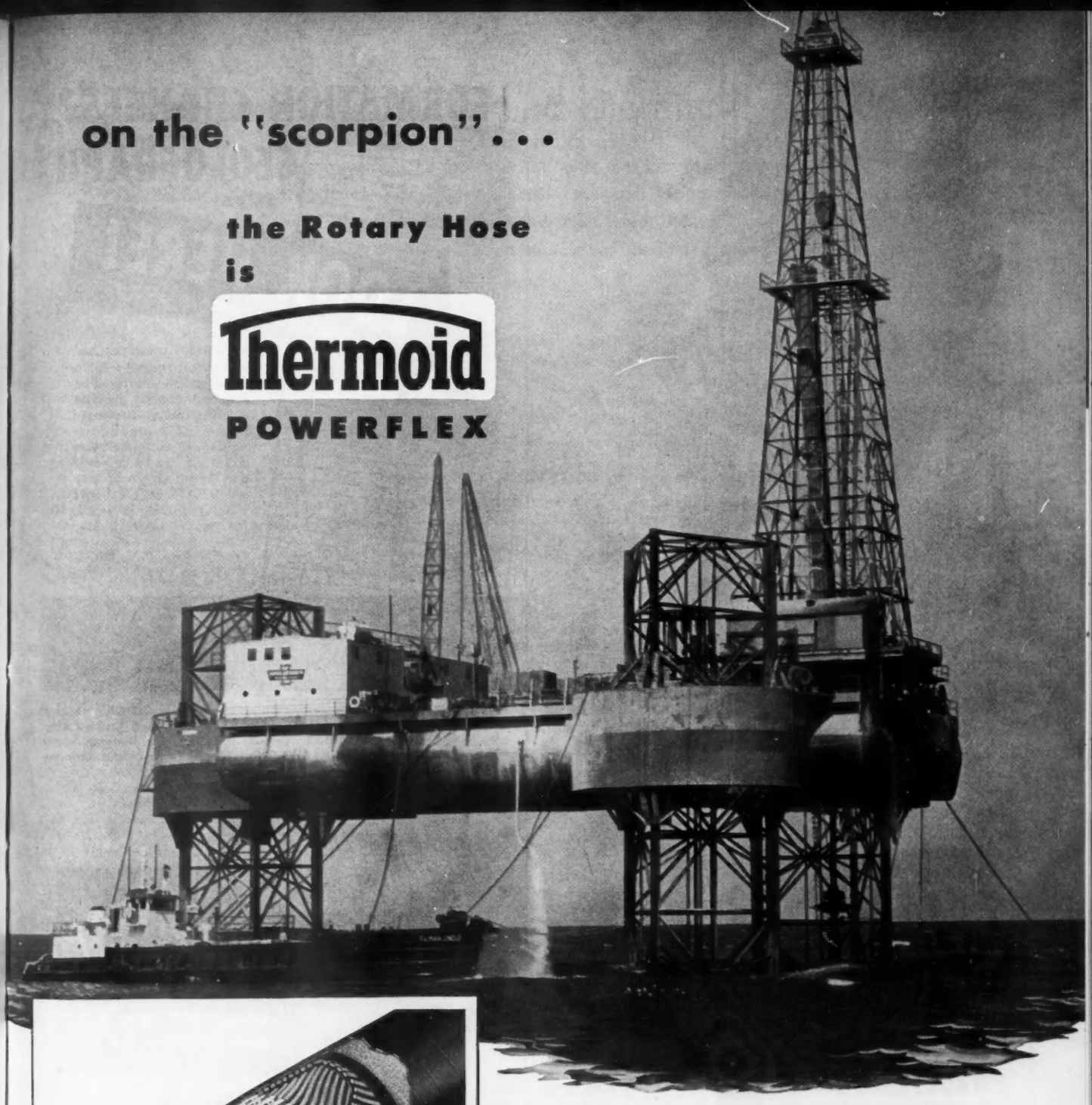
on the "scorpion" . . .

the Rotary Hose is

Thermoid

POWERFLEX



The patented full flow coupling at the left is just one reason why the Scorpion is equipped with Thermoid Powerflex Rotary Hose. It's an integral part of the cable assembly—cannot leak or pull off. The cable itself is made up of *33 miles of high tensile steel-wire* wrapped and counter wrapped. And the tube and cover of Powerflex Hose are made with oil and abrasion resistant Neoprene, reinforced with impregnated multi-ply woven fabric.

You'll also find Thermoid Suction and Discharge Hose and Thermoid Multi-V Belts "aboard" the Scorpion for the same reason—superior quality construction. Order Thermoid Oil Field Products from your nearest supply store or Thermoid warehouse.

Thermoid

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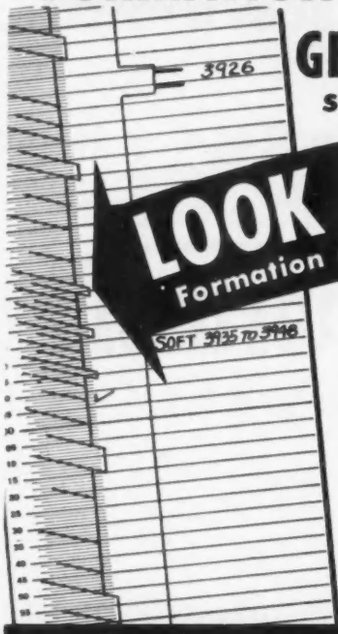

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GOTKOOL Water Cooler — made in 1½-, 2-, 3-, 5-, 10-, 15-, and 20-gallon sizes with either extended or recessed, flush-mounted faucet.

GOTKOOL Water Can — made in 1½-, 2-, 3-, 5-, 10-, 15-, and 20-gallon sizes without faucet.

Insist on the genuine — look for the *Blue and Black Label* with the name "GOTKOOL" in Red.

H. P. GOTT MFG. CO.
WINFIELD, KANSAS

New Equipment Catalogs and Literature

For more data on New Equipment or copies of Catalogs and Literature reviewed in this issue, use the Reader's Service postcards just inside the back cover and facing the Advertisers Index. Simply circle code numbers of items desired—sign and mail card. Requests are transmitted to the manufacturer as soon as received by us for mailing of desired information directly to you.

Diesel Information

Model 60 and Model 80 superior stationary diesels are shown and described in Bulletin #110 recently issued by White Diesel Engine Division, The White Motor Company.

The literature lists the engines as designed to provide low speed power for continuous, heavy-duty service. Engines are four-cycle, six or eight cylinder, inline models, ranging from 530 to 2000 BHP and from 300 to 1250 KW, are available either naturally aspirated or supercharged, and can be furnished to run as diesel, dual-fuel, or gas engines.

To get a copy, circle **No. E20** on Readers' Service Card, last page this issue.

Crosby-Laughlin Catalog

The new Crosby-Laughlin and Lebus catalog, recently announced by Crosby-Laughlin Division of American Hoist & Derrick Company, now covers all products manufactured and merchandised by that company.

Complete in every detail, the new catalog provides answers to every question which might be asked by anyone using or specifying drop forged fittings for wire rope and chain. It includes specifications, dimensions, rated capacities and weights on 11 items bearing the Crosby, Laughlin and Lebus trade names.

To get a copy, circle **No. E21** on Readers' Service Card, last page this issue.

Arc Welding Edition

The second edition of "New Lessons in Arc Welding" is a major revision of this text and reference book on manual arc welding. The book has been completely rewritten and reorganized to make it easier to read and use as a text or reference, and to include information on new procedures, machines and electrodes. Based on arc welding courses taught at the Lincoln Arc Welding School and the experience of other arc welding teachers throughout the nation, it is a practical text for teaching are welding in vocational, trade and industrial courses.

To get a copy, circle **No. E22** on Readers' Service Card, last page this issue.

Wire Rope Book

"Inspection of Wire Rope," "Methods of Lubricating Wire Rope," "Use and Abuse of Wire Rope," and "Sheave Maintenance" are but a few of the features covered in the wire rope manual prepared by Macwhyte Company.

In addition, there are sections devoted to strengths and weights of wire rope, cable assemblies, and rated capacity of slings. A complete reference guide on care and use of wire rope and slings, this manual is in handbook size (5 inches by 6½ inches) and tab indexed for quick reference.

To get a copy, circle **No. E23** on Readers' Service Card, last page this issue.

Rotorseal Brochure

Bulletin ML-177, a new six-page folder describing functions and applications of Fawick Rotorseals and quick release valves, has been published by Fawick Airflex Division, Fawick Corporation.

Rotorseals are used as a means of transmitting air, liquid or gases under pressure or vacuum from a stationary source into a rotating shaft. The bulletin includes full technical data on the complete line of Fawick Rotorseals. Complete dimensional data is given in table form.

To get a copy, circle **No. E24** on Readers' Service Card, last page this issue.

Wire Rope Assembly Folder

To save time and reduce cost, it is no longer necessary to make up cable assemblies by hand with splicing, clipping, etc.

Now precision lengths of wire rope with fittings permanently attached by swaging are prefabricated to order by specialists. Announcement showing examples of prominent manufacturers equipment using prefabricated "Safe-Lock" assemblies is contained in publication Ropeology No. 50 issued by Macwhyte Company.

To get a copy, circle **No. E25** on Readers' Service Card, last page this issue.

Stuffing Box Brochure

A new bulletin issued by Vernon Tool Co., Ltd., illustrates the "Standard" fluid-sealed stuffing box, pack-off stuffing box and the new lubricator type stuffing box.

To get a copy, circle **No. E26** on Readers' Service Card, last page this issue.

Ductile Iron Valve Booklet

A new bulletin describing in detail Kennedy ductile iron valves has just been issued by Kennedy Valve Mfg. Co. While Kennedy is already in production of ductile, or nodular, iron valves, the bulletin describes in specific steps the elaborate testing and research conducted by the company under the supervision of Professor J. O. Jeffrey of Cornell University before production was begun.

To get a copy, circle **No. E27** on Readers' Service Card, last page this issue.

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Advertisers' Index

• Dot preceding name of advertiser indicates that detailed data on products and services of the firm will be found in current 22nd (1957) edition of The Composite Catalog of Oil Field Equipment.

A

• ACF Industries, Inc. 140
American Chemical Paint Co. 16
American Cyanamid Co. Explosives Department 127
• American Iron & Machine Works 148-149
American Sand-Banum Co. 141a
Antara Chemicals Division General Aniline & Film Corp. 133
Avondale Marine Ways, Inc. 17

B

• B & W Incorporated 129
• Baash-Ross Tool Company Division Joy Manufacturing Co. 151
• Baker Oil Tools, Inc. 31 and 94-95
Bank of the Southwest 107
• Baroid Division National Lead Co. 167
• The J. B. Beaird Co. 161
• Bethlehem Steel Co. 43 and 71
• Bethlehem Supply Co. 69
• Black, Sivalls & Bryson, Inc. 105
Blaw-Knox Co. Equipment Division 15
• S. R. Bowen Company 96
• Brakesol, Inc. 156b
• Bucyrus-Erie Co. 173

C

Cable Engineering 160c
• Capitol Mfg. & Supply Co. 70a
Chicago-Wilcox Mfg. Co. 141b
Classified Advertising 163
• The Composite Catalog 152-153
• Continental Motors Corp. 128
• Fred E. Cooper, Inc. 90-91

D

Darling Valve & Mfg. Co. 68
Dayton Rubber Co. 169
Delta Air Lines 111
Dorr-Oliver, Inc. 136
Dover Corporation 22
• Dowell Incorporated 24 and 162
• Dresser Industries, Inc. 122-123
• Drilco Oil Tools, Inc. 50
• Drilling & Service Co. 101
Driltrol Corp. 145

E

• Eastman Oil Well Survey Co. 143
The Elgen Corporation 137
Engineered Oil Tools, Inc. 134
Equipment Engineers, Inc. 132

F

• Fluid Packed Pump Co. 102-103
Ford Motor Co. 72-73
• Foster Cathead Co. 154

G

G & H Towing Co. 55
General Aniline & Film Corp. 133
• Geograph Mechanical Well Logging Service, Inc. 176b
Geophysical Service, Inc. 44
• Globe Oil Tools Co. 65 and 147
• H. P. Gott Mfg. Co. 176c

H

• Halliburton Oil Well Cementing Co. 58, 114-115
• Hands-England Oilfield Equipment Ltd. 166
• Hercules Tool Co. 124
• HOMCO 171
Houdaille Industries, Inc. 135
• Hughes Tool Company 1

I

The International Nickel Co. 67

J

• Jensen Bros. Mfg. Co. 126
• Jones & Laughlin Supply Div. 11
• Joy Manufacturing Co. 14 and 151

K

• King Oil Tools 158
• M. M. Kinley Co. 130c and 177a

L

• Lane-Wells Company 181
• Larkin Packer Co. 33
• LeGrand, Sutcliff & Gell Ltd. 170
• Link-Belt Company 7
• Lone Star Steel Co. 21
• Lufkin Foundry & Machine Co. 125

M

• M & V Tank Co. 160b
Mack Trucks, Inc. 20
• Magnet Cove Barium Corp. 2
Manzel Division Houdaille Industries, Inc. 135
• Jas. P. Marsh Corp. 13
• John N. Martin Mfr., Inc. 89
• Martin-Decker Corp. 168
• McCullough Tool Co. 159
• McKissick Products Corp. 172
Midwest Oil Register 177b
• Miller Sand Pump Co. 160a
• Mission Manufacturing Co. 182

N

National Bank of Commerce 28
• National Lead Co. 167
• The National Supply Co. 35-38
• National Tank Company 87
• W. C. Norris, Manufacturer Division of Dover Corp. 22

O

• Oil Center Tool Co. 165
• Oil Well Supply Division United States Steel Corp. 8, 10
• Otis Pressure Control 106

R

Radiator Specialty Co. 130a
• Reed Roller Bit Co. 108-109
Republic National Bank of Dallas 176a
• Rockwell Manufacturing Co. 138-139

S

• Sargent Engineering Corp. 92
• Schlumberger Well Surveying Corp. 18-19
• Shaffer Tool Works 157
Sikorsky Aircraft Division United Aircraft Corp. 144
• H. C. Smith Oil Tool Co. 113
Southern Engine & Pump Co. 156a
• Spang & Company 174
Standard Oil Company (New Jersey) 9
Stitt Ignition Co. 130b

T

• Technical Oil Tool Corp. 46
The Texas Co. 110
• Thermoid Company 175
• Thompson Tool Co. 142
• Thornhill-Craver Co. 117
Trading Post Section 163

U

United Aircraft Corp. 144
• United States Steel Corp. 8, 10
• Universal Atlas Cement Co. 131

W

• W-K-M Division ACF Industries, Inc. 140
Warn Manufacturing Co. 70b
Warren Automatic Tool Co. 150
• Waukesha Motor Co. 12
• Weatherford Oil Tool Co. 121
Web Wilson Oil Tools, Inc. 118, 119
• Well Equipment Manufacturing Corp. 155
• Wichtex Machinery Co. 116

Y

• The Youngstown Sheet & Tube Co. 98

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